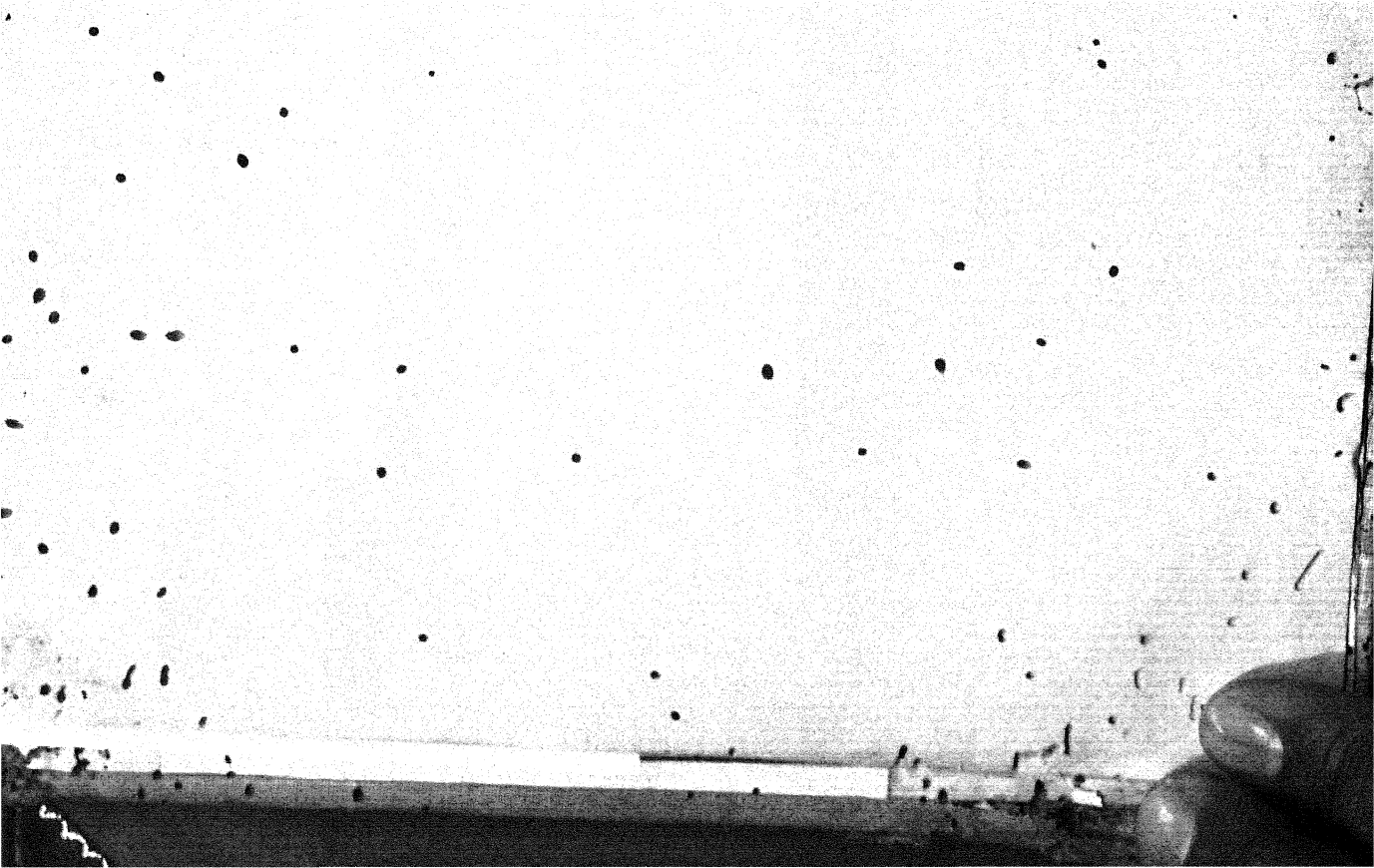

The Tactical Employment
of
Quick-firing Field Artillery

THE TACTICAL EMPLOYMENT OF QUICK-FIRING FIELD ARTILLERY

TRANSLATED FROM THE FRENCH OF

GABRIEL ROUQUEROL

MAJOR IN THE 16TH REGIMENT OF ARTILLERY

BY

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AUTHOR'S PREFACE.

THE adoption of the quick-firing gun has produced a feeling similar to that aroused by the introduction of smokeless powder, though of yet greater intensity. Doubt has been expressed as to whether the appearance of this novel engine, which revolutionises the methods of warfare, will not affect the battle teaching laid down in our Field Service Regulations, and whether, as regards artillery, the employment of this arm may not have to be completely modified. A number of inventive spirits have set their wits to work to discover what these modifications should be.

And yet the problem of the quick-firer was solved years ago. As far back as 1892 General Langlois, with rare foresight, established in an epoch-making work, the conditions under which modern field artillery should be employed. His opinion, after surmounting opposition on which it would be superfluous to dwell, constitutes the highest authority of the day. It is impossible, therefore, to approach such a subject without referring to it with all deference, and to do so

is indeed a labour of love for any officer who has had the honour, as I myself have, of serving under the personal orders of the General.

Whilst in France and among other Powers there is this conflict of different opinions, it is interesting to note that the Germans have made no sensible alteration in their regulations. This conservative policy, though carried to an extreme, is perhaps less dangerous than one of revolutionary change. If not justified, it is at least explained by the broad spirit of their regulations, which allows executive officers to adapt the means at their disposal to new conditions affecting the employment of the arm, should circumstances so dictate.

Confronted with this problem, it seemed to me that the surest way of appreciating the stability of principles and doctrine was to go back to their origin and trace their birth. I was then struck with the fact that they are in truth unchanging, and their importance stood revealed in the sharpest light.

But a knowledge of principles only does not suffice; it is their application that constitutes the art of war, and the history of campaigns shows that this application becomes gradually modified in proportion to the improvements in armament. Thus the merit of the Prussian artillerymen in 1870, after the experience of 1866, lay in having judiciously applied to the rifled breech-loader the

principles of smooth-bore artillery taken from the great epoch which had passed into oblivion.

I have therefore had recourse to history, and have tried by successive deductions to apply first principles to the equipment now in use.

The conclusions thus reached must further be confirmed by the test of practical experience in the field, by means of manœuvres and practice judiciously carried out. Without doubt the historical facts, from which these deductions are derived, took place under different conditions to those which will accompany the use of quick-firers; doubtless, too, manœuvres are but a poor school compared to war. But war cannot be made merely as a field for experiment, and the situation must be taken as we find it after the long period of peace that we have enjoyed in Europe.

In time of war, face to face with the real thing on his first battlefield, what will an artillery commander do who has not studied the conduct he should pursue? Will he trust to inspiration? It would be risky; the faculty of inspiration is the perquisite of few, and it has further been said with some truth to be the result of lightning calculations. Will he count on his personal experience of war? Such does not exist at the present day; at least, no commander can have had experience in the rank that he would now hold.

The Prussians have shown us how during fifty

years of peace to prepare for war. The great battles of 1870 are most instructive from an artillery point of view. *Matériel* in those days was, it is true, very inferior to that now at our disposal, but its inferiority was not such as to prevent us deducing, with some approach to truth, from the lessons of that campaign the modifications which the increased power of the arm may necessitate in its employment.

The majority of the examples serving as a basis for this work are, therefore, taken from the campaign of 1870, or rather, from three battles: August 18th (Gravelotte, Saint Privat), Sedan, and Beaumont. The two first are those which, of all the campaign, brought into play the most considerable masses of artillery; the last presents a characteristic example of the employment of artillery in a retreat.

Lastly, the recent war in the Transvaal, in which quick-firing guns have made their appearance, seems as though it should afford valuable examples of how to utilise their fire. But, as far as our present information goes, it does not appear to have given any conclusive indications as to the employment of large bodies of artillery, as much by reason of the abnormal character of the war as of the paucity of the batteries engaged and the lack of professional skill in their *personnel*.

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THE TACTICAL EMPLOYMENT OF QUICK-FIRING FIELD ARTILLERY

PART I.

THE QUICK-FIRING GUN AND ITS FIRE EFFECT.

CHAPTER I.

THE QUICK-FIRING GUN.

HISTORICAL RETROSPECT. During the course of a lecture delivered in March, 1895, to the officers of the St. Petersburg Garrison, General Englehardt, Inspector-General of Artillery in Russia, said:

"For some years artillery has been going through a regular process of fermentation."

The General was alluding to the question of quick-firing guns.

Rapidity of fire has always been considered one of the prime factors of increased efficiency, that is to say, gun-power. With this idea in view several attempts have been made since the end of the sixteenth century

in the direction of experiments relating to breech-loaders, but hitherto without success. The eighteenth century gunners, to be sure, with their primitive *matériel*, went very near perfection in the service of their weapons. On service, making use of the sights, they easily realised a speed of 1 round per gun a minute. At practice, with specially trained detachments and ricochet fire, more than 2 rounds a minute were accomplished without difficulty. With the help of special devices, and by sacrificing accuracy, field guns could maintain a speed of 4 rounds a minute. These rates of fire bear close comparison with those obtained from the guns in use immediately before quick-firers.

Scharnhorst.

de Gribeauval.

From these efforts to obtain rapidity the conception of a quick-firer was clearly destined to be evolved. In the year 1754, in fact, General Obenaus had some 6-pounders made in Saxony, with accelerated firing arrangements, and the same year saw Prussia adopting similar pieces of ordnance. Thirty years later the Saxon artillery possessed some light field guns which could, it appears, fire from 14 to 16 rounds of grape a minute. They were furnished with a special means of laying, which allowed them to be placed in a vertical position for loading, thus no ramming home was required, and the danger was lessened.

During this period rapid fire was sometimes employed with some measure of success; however, the practical results thus obtained were probably not very satisfactory, as the idea of a rapid fire gun seems to have been immediately abandoned. The construction of such an instrument could not be realised, in the stage which science had then reached, and with the limited industrial resources of the period.

It is hardly ten years ago that, in view of the

invention of smokeless powder on the one hand, and of the progress made in metallurgy on the other, the idea occurred to several that the time had come to reopen the question.

Among the Germans, General Wille, in a work which gave rise to heated discussion, formulated proposals with regard to his "gun of the future" which were then looked upon as extreme and chimerical, but have to-day been partly realised.

The Field Gun of the Future, by General Wille, 1891.

In France, General Langlois headed the movement, and laid down the basis of the principles which should determine the construction of quick-firing guns; the same, in short, which govern the artillery of the present day.

Constructors in all countries, seeing that from natural causes it would not be long before the Powers made a change in their armaments, set themselves to work.

While the professional talent of the various countries was keeping this process of transformation shrouded in mystery, private enterprise had already put on the market a selection of quick-firing guns of all calibres.

The "fermentation" mentioned by General Englehardt, which has resulted in the adoption of a quick-firer by all the Powers, is now, as regards *matériel*, beginning to settle down in the presence of accomplished fact. But the question of how to use such *matériel* is still the order of the day, and it is that which forms the subject of this work. Without entering into manufacturing details, it will suffice to take the data actually available as the basis for our study, that is, the conditions essential to the practical service of the gun, as also the effects produced by its fire. The characteristics of the different types now in use will furnish the elements for discussion. We will not concern ourselves for the

moment with the further progress already foretold by the prophets, which, perhaps, may not be far from fulfilment. Still, another radical transformation in the system of artillery equipment is not imminent; such could only be produced after a period of experimental research, and would require considerable financial undertakings, in addition to industrial progress.

WEIGHT OF GUN AND CARRIAGE. The weight of a field gun is limited by service conditions, independent of all improvements effected in *matériel.* The gun carriage and limber must be capable of manœuvre over all kinds of ground, at every rate of speed, with six horses at the most; the gun carriage proper must be equally capable of being handled by the detachment.

The word "independent," however, must not be taken too literally, for the mobility of a carriage does not depend entirely on its weight, and the working of its different mechanisms has to be taken into account.

After the experience of the wars of the Revolution, a commission, entitled that of the year XI., composed of the most notable artillery generals of the period, such as d'Aboville, Lamartillière, Marmont, Andréossy, and Gassendi, unanimously rejected the 8-pounder as too heavy. The 8-pounder gun, with its carriage and limber, weighed 32·48 cwt., and was drawn by four horses; the detachments, carrying their knapsacks, always followed on foot, and were never mounted on the carriages.

Our 80 mm. field gun weighed much the same as the old 8-pounder; it was drawn by six horses, and, when forming the armament of field batteries, carried the detachment with their valises. This piece was very

mobile, as the factors of mobility had been wonderfully improved since the smooth-bore days.

Improvement in this direction having now come to a standstill, it would seem that about 31·5 cwt. should be the limit of weight for a field gun, carriage, and limber. This is, in fact, the weight for which General Langlois stipulates.

General Rohne, an authority in Germany, is less exacting; he puts the maximum weight at 34·06 cwt. The weight of the German '96 pattern equipment is 33·46 cwt.

The weight behind the team of the Q.F. equipment manufactured by private firms in France and abroad varies generally from 31·5 to 34·45 cwt. for the heavy type, and from 27·56 to 31·5 cwt. for the light. The weight of the wagon is usually greater than that of the gun. It should be rather the other way, as a quick-firer, to make the most of its possibilities, should have its wagon alongside it; besides, once it is in position, the gun does not move during action, while the wagon has to be refilled or exchanged. The construction of two patterns of wagons has been suggested: a heavy one of large capacity, to take ammunition along the roads, or across country, at a slow pace, with a second of lighter make, which would accompany the guns during manœuvre, and on coming into action. This expedient would entail the grave inconvenience of having to tranship ammunition on the battlefield, and we should inevitably have the heavy wagons appearing in the firing line. It is in this direction, however, that a way out of the difficulty may possibly be found.

CALIBRE. We need not here enter into the details of the struggle between calibre and weight, that is, between power and mobility,

two conflicting conditions which a field gun must fulfil. This struggle was begun about the middle of the eighteenth century by the partisans of extreme lightness, and was kept alive in France by the celebrated quarrels of de Gribeauval and De Vallière; its end is not even now in sight, as it arises from the first principles of human nature. We will content ourselves with echoing General Muller's saying, that "immediately after a great war there is always a demand for increased power; during long periods of peace, on the other hand, this attribute is little by little relegated to the background, and we find the tendency towards increased mobility making its way to the front."

Développement de l'artillerie de campagne.

The minimum calibre for field artillery varies of necessity with each system. In de Gribeauval's it was that of the 4-pounder, viz., 3·27 inches, smaller calibres being practically abandoned.

To-day the limits within which calibre can be reduced depend more especially on the composition of the projectile. They are governed by the twofold consideration of facilitating ranging and obtaining sufficient effect against obstacles.

The employment of a quick-firing gun entails the adoption of as small a calibre as possible, to facilitate the service of the piece and to ensure the supply of ammunition. Almost all constructors, both in France and elsewhere, have adopted a calibre of 75 mm.[1] (2·92 inches); the calibre of the German '96 pattern is 3 inches.

With smooth-bores of very limited power it was

[1] Schneider, Canet, Chatillon and Commentry, Cail (de Bange and Piffard system), Saint Chamond (Darmancier system), Maxim, Nordenfeld, Hotchkiss, Krupp, Bofort, Finspong.
But the Elswick gun is 2·97 in., and the Swiss 3·27 in.

impossible to reconcile completely the conflicting conditions above mentioned, namely, power and mobility. Field artillery, therefore, had to include several calibres in order to fulfil its task satisfactorily under all circumstances. This obligation, fraught with the serious consequences of endangering ammunition supply, has remained in force to within the last few years.

To-day, owing to industrial progress, it is possible to realise the advantages of a universal calibre in the manufacture of a weapon combining power and mobility, which fulfils most of the requirements of field operations: such a gun will form almost the sole armament of artillery. It will, however, be necessary, as we shall see later on, to add a limited number of special pieces to provide for particular circumstances.

ATTAINMENT OF RAPID FIRE. The use of smokeless powder was indispensable to the proper working of a quick-firer, which would otherwise have been blinded by its own smoke, and have impeded its own fire. This initial difficulty being overcome, it was further necessary for the attainment of rapid fire:

(i.) To accelerate the return of the gun to the firing position.

(ii.) To accelerate the loading.

(iii.) To accelerate the laying.

RETURN OF THE GUN TO THE FIRING POSITION.—This is hastened by suppressing the recoil of the carriage, or, at all events, diminishing its extent. The recoil of the carriage can be reduced by means of brakes, but cannot be eliminated altogether without anchoring the carriage to a fixed point of support. It is precisely the existence of this support, easy to obtain on board ship, which has enabled the Marine Artillery to turn their permanent emplacements to account, and so to

solve the problem of the quick-firer before the Land Service, even for much larger calibres than field guns.

For the latter an anchorage was provided in the ground by means of trail spades, either fixed or movable, rigid or elastic.

But the suppression of recoil brought about an increase in "jump," and occasioned great strain on the structure. The use of wheel brakes was not sufficient to compensate the defects inherent to rigid carriages. The only remedy was to interpose between the gun and carriage some elastic medium—a spring or hydraulic buffer—capable of transforming the concussion of recoil into an action of compression which should be harmless to the *matériel.*

The carriage of the German '96 pattern equipment is a rigid one, with rope breaks, similar to the Lemoine break, and an adjustable trail spade. The effect of the spade is to make the carriage jump ; so it is only used when the ropes are insufficient, and also, as a rule, at rapid fire.

LOADING.—Greater speed in loading was obtained by improvements effected in the breech-fermeture, and by the use of fixed ammunition.

Thus the principle of having the cartridge and projectile in one was borrowed from the old smooth-bores, after being abandoned upon the introduction of rifled muzzle-loaders.

In the German '96 pattern equipment, the charge and projectile are not united in the form of a cartridge.

LAYING.—The suppression of recoil on the one hand, and on the other the action of the elastic buffer in running the gun up after each round to the same relative position as regards the carriage, enabled relaying to be done away with in carrying out rapid fire, as long as the

range and fuse remained the same, or at least to be done very rapidly indeed.

But this was not enough. To get a real quick-firer it was indispensable to provide a carriage admitting of corrections in laying being made, at least within certain limits, without moving the carriage itself. This result was arrived at by constructing so-called composite carriages, that is to say, composed of several parts capable of relative motion as to each other.

"The various natures of composite carriages known up to the present time may be classified under two types, distinguished by the way in which direction is given to the gun :

"(i.) The pivot system.

"(ii.) The slide system.

Notes on recent Changes in the Field Artillery of Europe, by Captain J. Decepts (*Revue d'artillerie*, Sept. 1898).

"*The Pivot System.*—The pivot system consists essentially of a main carriage carrying the trail spade, and axle, and a secondary carriage placed on top of the first, and connected with it by a vertical pivot.

"Direction is given to the piece by the pivoting of the top carriage on the main one. This system has the grave disadvantage of throwing the laying out by the very act of firing.

"For when the gun is pointed obliquely with regard to the axle, as is generally the case, the force of recoil slightly displaces the wheels in the opposite direction and alters the position of the main carriage. When the gun is run up and relaid for direction, it is placed still more obliquely than for the first round. After continued firing the angular displacement of which the top carriage is capable may become inadequate, and, in consequence, the trail will have to be shifted.

"The German pattern '96 carriage is of the pivot type.

"*The Slide System.*—The slide system consists essentially in a main rigid carriage carrying the trail spade, but not the axle. The latter can slide in a transverse groove formed in the breast of the main carriage. The gun is traversed by sliding the groove along the axle by means of a rack and pinion. The carriage thus pivots round the trail eye, the axle remaining to all intents and purposes at right angles to the general direction of the carriage.

"On the main carriage is mounted a cradle which carries the gun, and which can move backwards or forwards without altering in direction. It differs in this respect from the top carriage described above, which was only capable of movement round a vertical axis."

In composite carriages, therefore, the gun is capable of movement relatively to the medium of its connection with the carriage, and this medium can itself move relatively to the carriage. The combination of these two movements, by utilising the steadiness of the carriage, enables the operation of laying to be carried out more rapidly.

The perfecting of laying apparatus thus appears as a necessary consequence of the adoption of a quick-firer.

FUSE-SETTING.—The setting of fuses by hand was one cause of delay and inaccuracy in the execution of rapid fire. The use of an automatic fuse-setter does away with these drawbacks.[1]

RATE OF FIRE.—The speeds obtained vary from

[1] The French "*débouchoir*," or automatic fuse-setter, now in use, consists of a steel box, with sockets in which the shell are placed fuse downward, and a dial on which the range is set by a pointer. By a single downward pressure of a lever the fuse is punched at the proper gradation, and any number can be rapidly set in succession. (TRANS.)

8 to 15 rounds a minute, according to the pattern of equipment, the gun being relaid each time. Without correcting the laying, the speed can be considerably increased; thus it reaches 20 rounds a minute with the Darmancier pattern.[1]

The maximum speed of the German pattern '96 gun is 8 rounds a minute, or more exactly 50 rounds a minute per six-gun battery, according to the regulations.

As a matter of fact we must not exaggerate the importance of maximum rates of fire when they reach these limits. If the fire is accurate and effective it will disorganise the enemy at once, whether at the rate of 8, 10, or 12 rounds a minute. If it is inaccurate, or, for some reason or other ineffective, the rate is of little account; on the contrary, the greater the speed the greater the disadvantage, from the point of view of wasting ammunition.

The points, then, which conduce to the superiority of one gun over another are, the arrangements for serving it, the mobility of the gun and carriage, the strength of materials, the composition of the projectile, etc. In every case, whatever the pattern—and this is the point which most concerns us—its employment in the fight will be the same.

SHIELDS. If a gun by its recoil obliges the detachment to step clear from their posts at the moment of firing, the addition of a shield to the carriage cannot be justified. The benefit of momentary cover to the *personnel* does not compensate for the disadvantage of the increase in weight to *matériel*.

It is not the same thing when the gun does not recoil;

[1] Even more than this has been realised with special detachments. (TRANS.)

the protection given by the shields becomes, in that case, permanent and most effective.

This is what General Langlois expressed ten years ago, when he said, "The shield-protected carriage is the corollary to the quick-firing gun."

At the same time we may expect that, in time of war, artillery that is not provided with shield-protected carriages will make use of portable shields. True, such would be only a makeshift, not to be employed under normal conditions, but might do good service under certain circumstances.

CHAPTER II.

FIRE EFFECT.

DEGREE OF VISIBILITY IN ACTION. The discharge of a gun firing smokeless powder is distinguishable not only by the flash, but also by the dust which it raises.

In order to conceal the tongue of flame from the enemy, the gun must be placed about 13 feet below the covering crest. But the nature of the background behind the battery largely influences the visibility of the flash. Thus in the action of Elandslaagte, on October 21st, 1899, "the position of the Boer artillery, about 4400 yards from the British, could only be distinguished by the flash of discharge, which was plainly seen against the dark background of the hillside, at that time in shadow." As to the dust raised, it depends on the nature of the soil and its degree of dryness.

FROCARD and PAINVIN, *The Transvaal War* (Paris, Cerf, 1900).

PRODUCTION OF SMOKE IN PROJECTILES. To facilitate ranging, endeavours are made to get a projectile producing a dense puff of smoke.

A period of rapid fire results, therefore, in the target being enveloped in a thick cloud of smoke, which is more or less lasting according to the atmospheric conditions. This production of smoke by quick-firing artillery constitutes a factor, which, if not entirely new,

has singularly developed in importance. The interposing of this veil is a drawback to each of the adversaries as regards firing, but an advantage from the point of view of protection; taking it all round the advantage rests with the assailant.

Notwithstanding the veil of smoke the assailant can continue to fire at the target after it has become invisible if he has been careful to "register"[1] his fire; in addition, he is able to see the other parts of the battlefield. All this time the defenders are blinded and powerless.

As regards the protection given by the smoke-curtain, if the defenders take advantage of it to slip away or manœuvre, the attacking side can equally profit by it to manœuvre or advance. Now, in attack, every forward movement is so much gained.

HEIGHT OF TRAJECTORY.

The successive improvements made in firearms have resulted from various causes, on which it is unnecessary to dwell here, in decreasing the height of the trajectory.

A very flat trajectory is an advantage for the rifle, as it increases its dangerous zone; in a field gun it is a disadvantage. Except against obstacles, a shell does not produce its effect by direct hits, like a bullet or the old round shot, but by its burst. To lower the trajectory is, therefore, to increase the dangerous zone, not for the enemy, but for the troops of one's own side placed in front of the artillery. The height of the trajectory at 2200 yards with the German '96 equipment is 118 feet, with the 1873 equipment the height

[1] The word "*repérer*," constantly made use of by the author, is a drill-book term; it means finding the range and fuse of certain targets and then picking up an auxiliary mark, or aiming point, and noting its training with reference to the target. (TRANS.)

was 157 feet. The comparison of these figures gives food for thought. Again, the decrease in angles of descent results in an extension of the safety zone given by a covering mass to an adversary sheltered by it.

PROJECTILES. SHRAPNEL SHELL.—The true projectile for modern field artillery is the shrapnel shell, that is, a shell containing bullets fired with a time fuse.[1] The employment of this nature of fire necessitates the use of an accurate fuse capable of acting at all ranges.

The idea of using guns to fire hollow projectiles, bursting at the end of their flight, is a very old one; we find it in the fifteenth and following centuries, but devoid of any practical application. The earliest employment of hollow projectiles in France goes back to 1634 for mortars only, and to the end of the same century for howitzers. The adoption of the latter weapons gave rise to great opposition; the first to be introduced in France were cast in 1749.

Hollow projectiles could not really be used, except with short pieces, as long as the act of firing was performed in two motions. It was a delicate and dangerous operation, in which the bombardier set fire separately to the fuse and the charge. From the middle of the eighteenth century shells were fired in one motion, the fuse being lighted by the flame of the cartridge.

In France efforts were thenceforth made to bring shells into general use by firing them from guns; secret experiments had been made in this direction in 1760, and later at Meudon in 1793-4, with favourable results.

[1] "Time shrapnel is the projectile, *par excellence*, of field artillery against all animate targets which are not under cover" (*Drill Regulations for German Field Artillery*).

In 1789 General le Duc asked that hollow cannon-balls should be adopted, in order to do away with howitzers, and reduce the number of calibres used in the field. Four years later General Andréossy expressed the same desire.

Nevertheless, this trend of opinion, so accentuated in France, met with very decided contradiction abroad, in the writings of men like Decker, or sceptics like Scharnhorst.

The idea of hollow projectiles was taken up again when rifled guns came in, and their application was perfected. With the old primitive wooden fuse, in several lengths, the projectile burst on arriving at the end of its flight, after a more or less varying space of time. Attempts were made, therefore, to get a more accurate burst, either at the moment of the projectile's impact with the target or the ground, or else in the air, so as to produce a cone of splinters scattering downwards on to the objective (time shell).

In France shrapnel shell with time fuses were manufactured, which gave appreciable results up to 1400 yards. Unluckily, before the problem was satisfactorily solved, and while data on the subject were very incomplete, this measure was extended to common shell. The time fuse with which they were provided had only two gradations,[1] 1650 and 3200 yards approximately. At other ranges their fire was not and could not be effective. It was with such projectiles as these that the French Artillery entered on the campaign of 1870, and this was one of the causes of its inferiority to that of Germany.

[1] In reality there were four gradations, but, from the constant mistakes made by the illiterate gunners in boring the fuses, it was thought better to keep to two only.

Here, for instance, is one example out of a hundred related in the German Headquarter Staff account:—"At the time of the assault on St. Privat, the French Artillery, in position near the Amanvillers Quarries, seemed soon to have come to the end of its percussion shell, and, as a last resource, was firing nothing but time shell, which, from their defective make, produced very little effect." G.O.A. p. 856.

During the second part of the campaign, therefore, we had to come back to percussion fuses; the Germans, who had never abandoned them, found themselves far better off.

For a time shell to be really effective it is not sufficient for it to burst at the right distance and height, it must further produce a sufficiently dense cone of destructive particles, not only a few splinters scattered at random over a large surface; otherwise it is better to burst the shell on impact in order to produce a powerful, though local, effect. This was the case with spherical shell, which made twenty-five to fifty pieces dangerous within a radius of 20 yards.

For this reason also the elongated common shell of 1870, with their twenty or twenty-two fragments, even had they been provided with good time fuses, would have been still less effective than if fired with percussion fuses.

One of the problems on the solution of which depended the production of a quick-firing gun, and of which the difficulty was specially increased by the diminution of calibre, was precisely the manufacture of an efficient time shell. This efficiency depends on the number of projectiles, either splinters or bullets, produced by the burst of the shell, as also on their velocity.

The remaining velocity of the shell is the principal factor in the velocity of the bullets. We see, then, that remaining velocity is of more importance to the end in view than initial velocity; the latter figures only indirectly, as regards range, accuracy, and preservation of velocity, and is not of itself intrinsically important.

To increase the number of bullets one must diminish their volume. For a metal of given density it is impossible to go below a certain limit without fear of making the projectiles too light to have more than a very limited destructive effect.

There is, therefore, every reason in manufacturing the bullets to use as dense a metal as possible. General Wille has on this account proposed tungsten as a substitute for lead, of which the density is scarcely half that of the former metal (9·5 compared to 17). Up till now, however, the manufacture of this article does not seem to have been practically undertaken.

Kriegs technische Zeitschrift, 1899.

The German '96 pattern shrapnel comprises 300 bullets of hardened lead, 45 to the pound; it furnishes besides about 135 splinters. Its initial velocity is about 1525 f.s., its remaining velocity at 5550 yards is more than 754 f.s., according to General Rohne.

Basing our calculations on the data tabulated in General Langlois' work, we find that the German shrapnel bullet, fired at a range of 5550 yards, would retain sufficient force to put a man out of action 440 yards from the point of burst.

Time shell, so terrible against troops in the open, is powerless against men under cover.

The angle of the cone's dispersion is, on an average, 21° or 22° for the German '96 pattern.

Let us suppose that the projectile is fired at an enemy sheltered behind a wall, 6 feet 6 inches in height, at an average range of 2700 yards, that is, with an angle of descent of 5°. A simple calculation shows that under the most favourable circumstances, that is, supposing the projectile to burst on the actual crest, the enemy will secure a zone behind the wall of about 24 feet in length sheltered from bullets.

If the burst occurs anywhere in the line CX., the angle of descent being the same, and provided that the height is not great enough to neutralise all destructive effect, the zone of protection remains the same; but the depth of this zone increases very rapidly directly the point of burst leaves the line CX.

The subjoined figure shows that the smaller the angle of descent—that is, the flatter the trajectory—the greater will be the zone of protection given by the

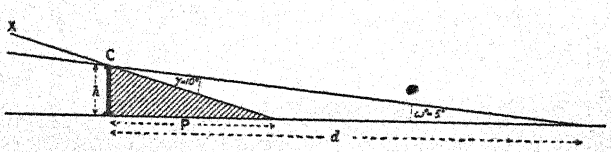

FIG. 1.

Zone of protection (shaded) given by a wall 6 ft. 6 in. high, against the German '96 pattern shrapnel shell, fired with time fuses at a mean range of 2700 yards.

Let h = height of wall, $w°$ the angle of descent, P = depth of protected zone.

Let d = distance from foot of wall to intersection of trajectory with the ground, and γ = half the angle of the cone of dispersion.

Then $d = h \cot w$.

and $P = h \cot (\gamma + w)$.

So if $h = 6$ ft. 6 in., and $w = 5°$, and $\gamma = 10°$,

We get $d = 75$ ft., and P = 25 ft. approx.

obstacle. We are again led, therefore, to the conclusion already formulated: that in field artillery fire there must be no attempt to exaggerate the flatness of trajectory—in other words, the initial velocity.

Revue d'artillerie (Jan. 1896).

This was the idea expressed by Major Mariani when he said "the extraordinary power acquired by field guns led in certain cases to loss of power."

The sole method of reaching an adversary crouching behind a wall is to pierce the wall and burst the shell behind the protecting obstacle—in other words, by firing percussion shell.

Shells will, as a matter of fact, to our knowledge, go through ordinary walls. If the covering obstacle is an earthen parapet, the projectile will burst, and make more or less of a crater. The defenders will be unharmed, except in the case of a lucky shot on the actual crest.

HIGH-EXPLOSIVE SHELL.

After the invention of high explosives, or rather, when they were applied to artillery, it was thought that an effective means of destroying obstacles with field guns had been found; besides which the results from detonation of high explosive shells were of such a nature that it was believed they could be used against defenders under cover.

The spread of the cone of the German '96 pattern high explosive shell, fired with time fuses, is about 100°; that is to say, the burst gives a sheet of splinters which descend almost vertically. If it bursts exactly on the crest, the projectile will therefore catch the defenders, even if crouching at the very foot of the wall.

The depth of the protected zone given by a 6 foot 6 inch wall at medium ranges against the German '96

pattern high explosive shell is only about 4 feet 6 inches, as shown in the following figure:

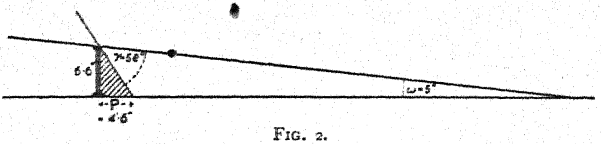

FIG. 2.

By the former method, $\gamma = 50°$.
and P = 4 ft. 6 in. approx.

The projectile is shattered into an innumerable quantity of little fragments, and the effect produced is extremely violent close to the point of burst; but from lack of weight the splinters lose all destructive effect beyond a radius of a score of yards.

However this may be, the foregoing considerations show that there are two ways of employing high explosive shell.

(i.) AGAINST OBSTACLES.—The shell is but the vehicle of the explosive matter, which must be present in as great bulk as possible; so the shell will have thin walls, and a percussion fuse will suffice. This is the French system.

It must be added that the effect produced by high explosive shell is much less violent than might be supposed from the actual power of the explosive. This is because of the small quantity that field calibres contain. The destructive effect is greater than that of percussion shrapnel, and makes itself felt, especially in enclosed spaces, where it acquires enormous power. But in open ground the effect varies very much according to the nature of the soil on which it strikes. At the battle of Magersfontein, December 11th, 1899, according to the correspondent of the *Morning Post*, "the effect produced by the English lyddite shells was

FROCARD and PAINVIN, p. 341.

much less deadly in the sandy ground, where the Boer trenches were placed, than on the rocky slopes of the koppies."

(ii.) AGAINST PERSONNEL UNDER COVER.—The object is in this case to produce a large number of destructive fragments; the shell will, therefore, have thick walls and a small bursting charge, and will be provided with a time fuse.

This is the German system.

To produce any effect the shell must burst on top of the covering crest; this necessitates very accurate shooting and a delicately graduated fuse.

The Germans do not really seem to entertain any great illusions as to the value of such action. Since the adoption of special calibres, which, as we shall see later, have been built to supplement the lack of power of the smaller natures under certain circumstances, they have evinced a very decided feeling against the 77 mm. high explosive shell.

General Rohne, who was responsible for its introduction, goes so far as to ask that it shall be abolished. "My opinion," he says, "is that the 77 mm. high explosive shell, the adoption of which I advocated, has not realised what its trials led one to expect, and in actual war will be still more disappointing. As long as there was nothing better to replace it I did not mind, but now I propose that it should be abolished altogether."

Kriegs technische Zeitschrift, Vol. VIII. 1899.

The German drill-book has adopted this view in relegating nearly all the high explosive shell to the light ammunition columns, expecting its employment to be exceptional. To obviate any doubt as to the meaning of these instructions, it adds: "As a rule, only specially designated gun units will be told off to perform duties similar to howitzers, and it will then

be often for the purpose of acting in combination with the latter." German F.A.D. § 323.

EMPLOYMENT OF VARIOUS NATURES OF PROJECTILES.

To sum up, apart from the question of ranging, according to the German drill-book the two sorts of time shell are used against *personnel*, time shrapnel against troops in the open, high explosive time shell against troops under cover.

The two kinds of percussion shell will be used.

(*a*) On the defensive at close quarters, at ranges below 1650 yards, when time shell are not used. High explosives are only employed as a makeshift in the absence of shrapnel, or when there is no time to change from one to the other.

(*b*) At ranges of over 5550 yards, for which there are no fuse graduations to correspond. The use of high explosive is then advised.

(*c*) Against targets offering a certain amount of resistance. "Shrapnel and high explosive shell have about the same effect. But inside buildings the destructive power of the latter is the greater."

The regulations do not legislate for firing high explosives at troops in the open, when, for some reason or other, shrapnel cannot be used. In such cases it would seem better, in theory at any rate, to use percussion and not time fuses. The characteristic of high explosives, as we have noticed before, is as much the wide cone of dispersion as the large number of splinters; the effect is at the same time very local owing to the light weight of these splinters. To get the best value out of these centres of destruction, there is every reason therefore, to produce them on the ground and not in the air.

Finally, however we look at it, we shall find that no

material destructive results will be obtained with field guns except at the cost of a vast expenditure of ammunition whatever nature of projectile is employed. A methodical destructive fire can only be carried out at close range, say 1650 yards. Against earthworks the material effect is almost *nil*.

INCENDIARY EFFECT. In the attack of localities, one of the most effective uses of artillery is to set them on fire.

The artillery of former days had a complete outfit of illuminating and incendiary shell, specially for siege purposes. The practical range of these projectiles was small and their fire uncertain, owing to their lightness.

The incendiary effect of a shell depends both on the spurt of flame from the fuse and the explosion of the bursting charge in the projectile. The old shells with wooden time fuses had great power in this direction. The improvements effected in artillery have, unfortunately, resulted in diminishing this property; and it would be advisable that researches should be made with a view to increasing it in the shells now in use.

"Shrapnel," says the German drill-book, "has an incendiary effect; that of high explosive shell is somewhat uncertain."

CASE SHOT.—Case shot was the characteristic projectile of the smooth-bore, just as time shrapnel is that of the present gun.

The effective range of solid shot, other things being equal, was only about 200 yards greater than that of "canister," according to the expression of the time—a much more accurate one, to be sure, than the term "grape." For instance, the furthest effective range of the old 4 pr. smooth-bore was from 550 to 650 yards for solid shot, and from 450 to 550 yards for canister.

This simple fact explains the relative importance of case shot in the artillery of olden times.

The adoption of rifled muzzle-loaders, which induced a noticeable loss of initial velocity, diminished the efficiency of case shot. With rifled breech-loaders this efficiency fairly well recovered itself to what it was in smooth-bore days. But circumstances in general had entirely changed; medium ranges had become 2200 to 2700 yards instead of 550 to 750 yards. The only use of case seemed to be in surprises or the final stages of a fight; this necessitated the rapid performance of a very delicate operation at critical moments of the greatest excitement, namely, a change in the nature of projectile.

School of gunnery experience showed what might be expected to happen on service. So the regulations wisely directed the use of shell at close quarters, with either percussion fuses or time fuses set at zero.

The experience of the war of 1870 was a fairly good guide as to requirements. During the whole course of the campaign the German batteries fired only 281 case shot. The batteries of the Prussian Guard which of themselves fired 25,000 shells, expended only one round of case. "This one," adds Prince Kraft in reporting the fact, "had got broken in transit."

True, one might object that the German artillery in 1870 rarely had occasion to fire at case range. Still, given a quick-firer which allows of point-blank effect with shell at least as deadly as that of the best case shot, it was permissible to wonder whether the retention of such a projectile was justified.

General Wille expressly asked for its abolition. To-day this is an accomplished fact.

In Germany at ranges below 300 yards they carry

out rapid fire with percussion fuses laying over the sighting notch and the handspike.

VULNERABILITY OF ANIMATE BODIES. The areas given by plotting in a vertical plane a man standing up, a man lying down with head and shoulders covered, and finally a mounted man, including his horse, are respectively.

M = man standing up . . = 5·1 square feet.
m = man lying down . . = 1·3 „ „
H = horseman . . . . = 12 „ „

If the trajectory were horizontal, taking the trajectory of the projectile as being the mean or axis of the cone of dispersion, the value of these areas would theoretically represent their vulnerability. But as the trajectory makes an angle with the horizontal, we must compare the projections of the vulnerable areas, modified by the angle of descent, either in a vertical or horizontal plane.

It is easy to see from the figure below than for an angle of descent of 5° the vulnerable surface of a man

FIG. 3.

Let M_v, m_v, H_v be the projections of M, m, and H in a vertical plane;

and M_h, m_h, H_h be the projections of M, m, and H in a horizontal plane.

Then we see from the figure that

$M_v = M$	and	$M_h = M \cot 5°$
$m_v = m + M \tan 5°$		$m_h = M + m \cot 5°$
$H_v = H$		$H_h = H \cot 5°$
$m_v = 1·7$ sq. ft.	and	$M_h = 57·8$ sq. ft.
$m_h = 19·7$ sq. ft.		$H_h = 136·9$ sq. ft.

That is M_h is approximately $m_h \times 3$.

standing up is three times greater than that of a man lying down with his head and shoulders hidden. Had we merely compared the areas given above, we should have arrived at the inaccurate conclusion that the vulnerable surface of a man standing up was four times greater than when lying down.

Let N be the number of bullets or splinters distributed over a zone of S square feet.

Then the number of hits on a single man will be:

Standing up . . .	$\frac{N}{S}M_h$
Lying down . . .	$\frac{N}{S}m_h$
Mounted man and horse	$\frac{N}{S}H_h$

Then suppose several men placed on the beaten zone; if there is at least one hit per man, that is, if there is one bullet per vulnerable part of the man, referred to the horizontal plane and the angle of descent, it is equivalent to saying that, in theory, supposing the bullets to be equally distributed, all the men would be hit.

At the same time, these formulæ do not apply unless men are placed at such distances behind one another as will prevent one man protecting another;[1] this protection we may neglect in the case of men lying down, but where they are standing up it is very effective. It would be complete if trajectories were horizontal.

[1] This applies, of course, only to shrapnel bullets which have not enough penetration to go through a man and be capable of further effect like the rifle bullet.

But, from the varying angles of the splinters, and trajectories, and the difference in height of bursts, by reason also of the uneven distribution of the fragments over the surface in question and the slanting direction of fire as regards the enemy's front, the protection thus given is essentially a variable and complex quantity; it is impossible to calculate its value even approximately.

The greatest number of men that can be placed on an area of S square feet, without the vulnerable surfaces projected on the horizontal plane with regard to the angle of descent overlapping one another, is given by the formulæ:

$$\frac{S}{M_h} \qquad \frac{S}{m_h}$$

according to whether the men stand up or lie down. Further than this the foregoing formulæ no longer apply.

The preceding considerations do not furnish any precise data; nevertheless they have a certain value as:

(i.) They afford a means of comparing the vulnerable surface offered by men in different positions.

(ii.) They bring to light the importance of the cover given by a man standing up to the man behind him.

(iii.) They show that the best means of determining the effect of fire on the practice range is to put up targets of which the *horizontal* surface shall correspond in all respects to the real objects; the number of hits on the vulnerable areas of men in different positions being then recorded.

(iv.) Finally, if it is required to take into account the precise degree of protection given by men standing up to those in the rear of them, targets must be placed to represent the formations in question, and of

such thickness as not to be penetrated by the shrapnel bullets.

Besides this, the protection given by an animate object vanishes as soon as it is knocked over. Therefore this protection varies during the whole period of fire in actual warfare. Consequently, to obtain conclusive results, falling dummies should be employed.

PART II.

THE FIRE-TACTICS OF ARTILLERY.

CHAPTER I.

THE NATURE OF ARTILLERY FIRE.—METHODS OF FIRE.

TACTICAL PRINCIPLES OF FIELD ARTILLERY. More than a hundred years ago, when artillery had been organised and equipped as befitted the part it was to play on the battlefield as a separate arm, the tactical principles governing its employment were already appreciated.

To make the most of its great possibilities, the action of artillery should be developed in depth. It should be as overwhelming and instantaneous as the bursting of a hurricane.

This, indeed, was the fundamental idea expressed by Guibert, in declaring that the duty of artillery "was not to fire at a particular point, but to cover a certain space of ground; the object being," he added, "not the mere dismounting of a wagon or the killing of a few men, but the all-important one of entirely covering by its fire the ground occupied by the enemy, and over which he wishes to advance. Artillery employed in this way is capable of tremendous execution."

Some years later, after the wars of the Empire, this theory was substantiated by Gassendi, who said that artillery should aim at "enfolding the whole battle-ground, or at least the part most covered with troops, in a fiery embrace, and should not confine itself to targets of limited extent." These lines might well be placed to-day at the head of all instructions as to artillery fire tactics.

Aide Mémoire for Artillery Officers, 1819.

How, it may be asked, could such results be obtained with smooth-bores? By grape-shot, of course, which, with its deadly sheet of missiles, formed an impenetrable zone of destruction in front of the guns. In order to realise this overwhelming effect, which acts on the enemy with such crushing force, Frederick the Great advised his artillerymen "never to fire grape beyond a hundred paces, and to fire their last salvo at fifty or sixty paces"; in other words, point-blank. So grape remained the characteristic instrument of smooth-bore artillery.

Frederick the Great's instructions to his Generals.

This idea of distributing fire in depth had taken root even in connection with solid shot. Whilst in France it was still the fashion to fire point-blank or by means of the tangent sight, in Germany Frederick the Great, and afterwards Scharnhorst, expressly advised the practice of horizontal, or, so to speak, rebounding fire, which was nothing more than an attempt at distribution in depth by means of that happy device, the ricochet. The gun was directed at the target, and laid almost parallel with the surface of the ground. Provided this was not too unfavourable, the shot, after first striking two or three hundred yards from the muzzle, described a series of destructive ricochets, gradually diminishing till it came to rest.

In reality it is true, whether fired point-blank or

with a ricochet, projectiles did much the same in the end, owing to the small angles of elevation and the nature of the soil. With such primitive tools as the solid shot or spherical shell, it was very difficult to create an absolutely impenetrable zone of destruction.

Nevertheless, the notion of distribution in depth can be distinctly traced to ricochet fire, and it may be said with perfect truth that the essence of field artillery fire tactics was evolved at the end of the eighteenth century.

When artillerymen found their equipment so improved they seem to have busied themselves in utilising the accuracy of their new guns to fire at particular points instead of spaces. Forgetting the teaching of their predecessors, they took no pains to make judicious use of the increased power of their arm.

In 1877 Hoffbauer indicated precisely how this power should be exploited, by reckoning the factor of time in calculating fire effect. "A rapid fire opportunely delivered with confidence assures the maximum effect from artillery in a given time."

Hoffbauer, *Field Artillery Tactics.*

However, the artillery was still to be seen practising at bull's-eye targets on the range, under anything but realistic service conditions. This was the reign of the short bracket.

Finally General Langlois did for field artillery in France what General Hindersin had done twenty years before in Germany for the tactical development of the arm. He summed up the notable advance made in *matériel* by saying that it "resulted in transferring to 3000 yards the point-blank and grape-shot fire of the smooth-bore." Taking this fact as his starting-point, he applied the old principles of fire tactics to the gun then in use, the 90 mm.

In order to get distribution in depth the General

began by absolutely barring the short bracket, and adopted long ones; then, to obtain the instantaneous effect, to produce that which he vividly termed the *rafale*, or shell-storm,[1] he conceived a special device which he called "*échelon* fire.' Lastly, he introduced a third very important factor in the efficiency of artillery fire, and one which could occur only exceptionally in the days of the old short-range weapons, namely, surprise.

This factor, greatly a question of *moral*, is not, needless to say, specially the perquisite of artillery. It can be brought to bear in every phase of war, but, as far as artillery is concerned, it would appear to follow directly from the increase in range, which makes it possible to conceal guns till the very moment of opening fire.

The most suitable means of effecting surprise is to register the range and fuse of certain areas beforehand; the ground can thus be swept at the right moment by a sudden gust of fire. If the battery had not already fired it would be a serious mistake to determine these data by trial shots; this would unfailingly reveal its presence beforehand in hopes of obtaining a problematical result in the future. In such cases the necessary information must be obtained either by means of range-finding instruments, by the map, or by reconnaissance.

General Langlois laid great stress on the fact that these different ideas had to be taken into account if the

[1] The word "*rafale*" is now a French drill-book term, and signifies a series of 8 rounds per gun throughout the battery, each two being laid with 100 metres more elevation than the last, and the whole fired off as rapidly as possible without further words of command after the first order. It seems best to keep the original word, as we have no term corresponding to its exact meaning. (TRANS.)

quick-firing gun, the adoption of which in the near future was of the first importance, was to make the most of its powers.

These notions as to fire tactics could not at first make headway against tradition. But they, at all events, created a current of opinion that in the end prevailed.

The ideas above quoted lead to the logical conclusion that the fire of quick-firing artillery should be characterised by very violent gusts of short duration, separated by more or less prolonged intervals of calm.

To reap the full benefit of the fastest rate of fire the maximum effect must be obtained in the minimum of time.

The demoralisation produced in troops by the losses they have suffered depends, indeed, on two different points—the percentage of loss and the time taken to produce this loss. The moral element of time acquires great importance which it is impossible to calculate, but the following examples will make it clear.

G.O.A. p. 693. On August 18th six German batteries of the IV. Corps, after having lost from 25 to 50 per cent.[1] in killed and wounded, were considered incapable of continuing the fight. They were withdrawn to refit, and afterwards came into action again, all except the second, which could not take any further part in the action. These losses had taken place after a struggle lasting three hours.

At Beaumont the 4th Battery of the 8th Prussian

	Officers.	Men.	Horses.
[1] 2nd Horse Battery . . .	2	36	102
3rd Light „ . . .	2	24	47
4th „ „ . . .	2	27	48
III. Heavy „ . . .	3	32	54
IV. „ „ . . .	3	45	49
II. „ „ . . .	1	23	70

Division, which had commenced the action, suffered losses as great as the batteries of the IX. Corps. It was equally able to refit and take part in the remainder of the fight. The time in which it had suffered these losses was about two hours.[1] G.O.A. pp. 1002-9.

On August 18th, at the time of the first attack made by the First German Army on the heights of Point-du-Jour, four batteries of the VII. Corps had crossed the Mance with the infantry. Two of them, the 4th and the IV., had to retreat under great difficulties, even leaving some guns behind on the ground, and "were unable to put in an effective appearance for the remainder of the day." Yet the losses suffered were considerably less than those of the IX. Corps batteries, but had taken place in a few minutes instead of three hours.[2] G.O.A. p. 773.

This moral element of time is of equal importance whatever be the arm that inflicts or endures such loss. It applies as much to infantry and the rifle as to artillery and guns. Thus on December 4th, 1899, at the battle of Magersfontein, the Highland Brigade lost over 25 per cent. of its strength in ten minutes, "it was demoralised for the rest of the day, and the battle was lost to the English from that moment. This result had been brought about in ten minutes." FROCARD and PAINVIN, p. 353.

DEVELOPMENT OF THE "RAFALE." The principle of the *rafale* being admitted, it is necessary to determine its elements; that is, its intensity and extent.

In approaching the question we must thoroughly

[1] Losses: Three officers, 26 men, 34 horses.

[2] Total losses of the 3rd Field Group, 3rd, 4th, III. and IV. Batteries: Killed, 2 officers, 8 men, 50 horses; wounded, 3 officers, 88 men, 9 horses. The German official account does not give the losses of individual batteries.

grasp this fact: that in war the means to be employed must be proportionate to the end in view. In other words, with the quick-firer, which is most extravagant of ammunition, it is not only necessary to attain the desired object, but it is further essential at the risk of serious after-effects to produce this result with as little expenditure of ammunition as possible.

The intensity of the *rafale*, and, therefore, the number of rounds composing it, will necessarily vary with circumstances and with the nature of the projectiles employed. Experiments on the practice range, carried out as far as possible under service conditions, will furnish as accurate data in this direction as it is possible to obtain without the verdict of the battle-field.

Time shrapnel is evidently from its nature the type of projectile to be used in *rafales*. But it would be contrary to the principle of the *rafale* to confine its use entirely to shrapnel. As we have seen, our predecessors endeavoured to realise it with smooth-bore cannon balls.

In all fire against *personnel*—I specify *personnel* as demolition fire is a special case and has nothing to do with the *rafale*—the *rafale* is essential, whatever nature of projectile is employed, and as much with time or percussion shrapnel as with high explosive shell.

Percussion shell *rafales* will doubtless produce far less effective results as regards distribution than time shell; but, on the other hand, they will be capable of localised effect which may in some cases be decisive. We shall see later on, for instance, that percussion shell *rafales* suggest themselves for use against localities.

By definition the *rafale* must have depth, as it has to sweep a certain depth of ground; but this depth varies according to circumstances. Its minimum depth is that

of the cone of dispersion of the projectile employed. Fire is in that case carried out at a fixed elevation, and the *rafale* may be termed a shallow one.

The deep *rafale* has the advantage of requiring less accurate ranging than the shallow one, of being delivered more rapidly, of creating a wider destructive zone from which the enemy will find greater difficulty in emerging. On the other hand, the shallow one will use up less ammunition, and, once the range has been found, will be more effective.

The deep *rafale* is produced by firing with different elevations so as to arrange the cones of dispersion suitably one behind the other. The different elevations can be used either simultaneously or in succession, from which we get two different methods of producing the *rafale*; the first called *échelon* fire, the second progressive fire. In *échelon* fire the ground is simultaneously swept from end to end; in progressive fire it is attacked in successive strips, perpendicular to the line of fire.

Both these methods have their advantages and their drawbacks. Each of them, as a matter of fact, is dependent on the *matériel* in use; the one which was preferable with a slow-firing gun loses its advantages with the quick-firer and *vice versâ*. It can merely be said that the use of the latter remarkably facilitates the execution of the *rafale* and increases its power.

As regards the words, *échelon*, instantaneous, progressive, their meaning must not be taken too literally with the quick-firing equipment. It is, indeed, a question, not of mathematical, but practical instantaneousness, from which there is no escape for the adversary.

The most serious defect of the so-called progressive

system consists, perhaps, in the adoption of this unfortunate word "progressive." The expression recalls an erroneous idea, due to the recollection of an obsolete method of fire, which indeed with the non-quick-firer gave a distinct sense of progression.

It would be out of place here to go into a technical discussion of the two systems.[1] The question of adopting one or the other is to my mind quite a secondary one. But it is essential that fire discipline should be sufficiently elastic to allow of the depth and density of the series being varied, to permit of projectiles being fired with either time or percussion fuses, so that, in one word, it may be applicable to all the changing circumstances of war.

It will be necessary, therefore, to avoid the use of a stereotyped, rigid system of fire discipline. The idea of unity and simplicity is very seductive. It may even be imposed, of necessity, when it is a question of licking into shape men who have lost their traditions and forgotten the first principles of their training, yet this is only a special case of a temporary nature. But simplicity carried to an extreme becomes a positive danger. It is fatal to attempt to tie down fire discipline with mathematical precision. Artillery fire tactics, like everything else connected with fighting, is not a science, but an art, and must be capable of delicate shades of expression, to use a picturesque term of General Lewal. Now this manipulation cannot be carried out if the system of fire discipline is not sufficiently elastic.

LANGLOIS, Vol. I. p. 398.

[1] *Échelon* fire is provided for in the Spanish Regulations. Its employment is compulsory at ranges under 1500 metres. It is noticeable that this range is the same as that at which the German Regulations order rapid fire. (*Spanish Manual of Practice*, October, 1897).

EMPLOYMENT OF THE "RAFALE."

From a purely speculative point of view a violent gust of fire, immediately following a rapid process of ranging, should succeed in annihilating any important objective in the field of fire, either stationary or in motion, before it has had time to realise the situation.

Such is the argument of the partisans of simplicity at any price. According to them the uniform employment of a sealed pattern series would answer all the various cases which present themselves in war.

Yet in practice, even on experimental ranges, where the conditions are far more favourable than on service, things do not happen so simply as in theory.

Often enough for some reason or other the series is retarded from delay in ranging; at times the ranging is wrong, the series non-effective, and everything has to be done all over again.

Against a stationary objective these incidents entail the grave disadvantage of retarding the opening of effective fire, perhaps giving the enemy time to range before one is ready to reply oneself; against a moving target it may mean that the opportunity of striking the opponent is irrevocably lost.

This is especially true with regard to cavalry; let the direction of its march be a little inclined to the line of fire, or the ground somewhat broken, and the artillery will only waste time and ammunition in trying to follow the course of a disappearing target, moving in different directions.

For these reasons Prince Kraft considers that the normal way of engaging a moving target should be to fire at certain areas of which the range and fuse have been determined beforehand. This system of fire is likewise entailed on batteries which are told off to

Letters on Artillery, by Prince Kraft, 8th Letter.

remain in observation, as we shall notice in connection with the fight.

Thus we see already that the *rafale* can and should be employed in two different ways, being delivered either immediately the range is found or not until after the range and fuse have been specially determined more or less in advance by various means, such as trial shots or measurements from the map, etc. The former method is more specially suited for firing at a stationary target, the latter for use at moving men. But there is nothing arbitrary about it. All that can be said is that both methods are of equal importance, and it is the business of the battery commander to apply them judiciously according to circumstances.

THE "RAFALE" ALONE INSUFFICIENT. SLOW FIRE.

The principal aim of artillery fire is incontestably the destructive or man-killing result which we term effective fire. But there is another result, moral effect, which may be produced by partially effective or even non-effective fire. This result should, it is true, be tried for only with the greatest caution, as it would more often end merely in confusion and an alarming waste of ammunition. However, it does become necessary sometimes, and cannot be eliminated when calculating the methods of employing artillery fire.

This is one reason why the *rafale*, even in its most elastic and handy shape, cannot form the sole method of using the quick-firer.

It is undoubtedly necessary that not only artillery, but also the other arms fighting alongside should be familiar with the employment of the *rafale*. It behoves the infantry in particular, without sustaining demoralising impressions, to accustom itself to these long periods of silence following the crash of fire, to

what I will describe by a somewhat odd but expressive term, the acoustic properties of the *rafale.*

Frederick the Great, with his masterly experience of war and profound knowledge of human nature, thought it necessary to warn his artillery officers "against the inopportune demands of infantry officers" who begged them to fire before the right moment. He added that these demands were sometimes made by commanders "with the sole object of distracting the attention of their own men."

Frederick the Great's Instructions to his Generals.

When such a contingency could not be avoided, he, the partisan of "rapid and continuous fire," in other words the advocate of the *rafale,* advised his artillery to fire as slowly as possible.

Such advice, given by such a man, seems worthy of consideration, and will certainly apply to the quick-firing gun, the weapon *par excellence* of the *rafale.*

Since Frederick the Great's time man has not changed. Man, with his nerves and impressionable disposition, notwithstanding all the improvements in armament, remains the primary instrument of warfare. Much may be asked of him within certain limits, but there is a limit which may not be overstepped.

It would be seriously imprudent, in determining our methods of fighting, to imagine that this limit was so very wide, especially with troops that have never been under fire and in the presence of the formidable engines of war now in use.

When an infantry man, lying down under the enemy's fire, sees a gun, which he has been told is so mighty, remaining silent close by, will it be possible to convince him that this silence is judicious?

Later on, when the same man is advancing towards the enemy, leaving the gunner in position behind him,

will he be able to reason as at manœuvres, and say to himself that his comrade is watching and will come to his assistance at the right time?

No: the only moral support that this infantry man will get from the presence of artillery is from the evidence of his own senses, and as he cannot see the material effect produced by its fire, the only thing to help him will be the sound of the gun itself.

History of the Franco-Prussian War, by Colonel Rousset.

"The significant rattle of the machine guns," says Colonel Rousset, "had a magical effect in 1870 on the *moral* of the soldier. It oftened happened that, when a body of troops had been decimated and was beginning to give way, it was easy enough to steady it by sending forward a battery of machine guns, which at once opened fire at any cost, on no matter what target. This was the greatest achievement of that highly-vaunted weapon.

Conversely, if the artillery is silent for any length of time, it will allow hostile troops that have been silenced but not completely shattered to pull themselves together again. And how can one be certain that a single *rafale* will have shattered the adversary? These same troops, if they continue to receive an occasional round, even comparatively ineffective ones, will be unable to refit and will be put out of action permanently.

Let us, then, consider from this point of view how the Germans employed their artillery on August 18th; it will show us a very typical case, as the line of guns deployed was a formidable one and remained in action for many hours, during which a heavy fire, continued without intermission, would have been an impossibility.

On the northern part of the battlefield, when the XII. and Guard Corps were in action a little before five o'clock, in accordance with Prince Frederick Charles's orders "to carry on the fight with artillery only, until

the XII. Corps had outflanked the French right wing . . . there occurred a general cessation of fire along the whole front of the II. Army; the German artillery alone kept up a deliberate fire." G.O.A. p. 732.

In the centre, the efforts made by the IX. Corps against the heights of Amanvillers had failed. "The Prussian troops found themselves very hard pushed and unable for the time to gain ground. The fight came to a standstill. . . . South-east of the wood of La Cusse the batteries of the IX. and III. Corps, twelve batteries in all, kept up a slow but continuous fire, principally directed against the infantry." G.O.A. pp. 813-816.

Thus the employment of their artillery by the German leaders was the same in different parts of the vast battle-field. After the acute crises, during which they delivered as violent a fire as possible, they carried on with steadiness and deliberation. If, instead of their slow-firing equipment, they had had quick-firers at their disposal their general procedure would have been the same.

At Sedan the II. Bavarian Corps had been given the task of preventing all attempts of the French to break out to the south of the town on the left bank of the Meuse. How did the reserve artillery of this army corps—in other words, the corps' artillery—interpret the part it had to play in carrying out these orders?[1] "By keeping up a deliberate fire against the exits and approaches of which the enemy might make use." This fire did very little damage, but it was the only way of doing any good "while still reserving sufficient ammunition in case the enemy should seriously attempt to break through." G.O.A. p. 1140. G.O.A. p. 1215.

We shall see later on that, independently of the foregoing considerations, deliberate fire is necessary

[1] The divisional artillery had been given a different task.

sometimes to obtain material results, either for demolition or smoke-producing purposes.

GERMAN METHODS OF FIRE.

It would be difficult to deduce a doctrine of artillery fire, similar to that propounded above, from an examination of the German system. The latter, indeed, seems to give one the idea of dreading the *rafale*. This fact is interesting, coming as it does from a country which first gave official recognition to rapid fire and distribution in depth, under the patronage of men like Frederick the Great and Scharnhorst.

German F.A.D. § 321.

The German regulations provide for three normal rates of fire:

Slow fire (no special rate laid down).

Ordinary fire, four to six rounds a minute per six-gun battery.

Rapid fire, which reaches fifty rounds a minute per six-gun battery.

"The tactical situation alone decides the rate of fire." As regards rapid fire, its use is curiously restricted. "It will be made use of in order to take advantage of a fleeting opportunity in the fight, or to obtain the maximum effect in a very short time."

German I.P. § 71.

The Manual also, in order to avoid what it doubtless looks on as waste of ammunition, lays down that "rapid fire is carried out at stationary targets under 1650 yards inclusively, and against moving targets." So there are no *rafales* as a rule, at least, against stationary targets beyond 1650 yards, nor any *rafales* of common shell except under special circumstances.

The rapid fire series, when it is employed, is also based on the short bracket, which the Germans make a point of always using. They carry out effective fire with fixed elevation, and do not appear to admit the

principle of distribution in depth. They only resort to this when, for some reason or other, it has not been possible to range accurately.

Their normal procedure against moving targets is the employment of previously "registered" zones; it is only in cases where this registration of the ground has been impossible to carry out beforehand that they have recourse to the bracket system of our old manuals.

To sum up, the *rafale* series and deep distribution are inadmissible in the German system of fire discipline. On the contrary, the short bracket and a moderate rate of fire is the normal practice.

It follows that their fire is not characterised by a succession of gusts and periods of calm, but shows rather rapid fire alternating with slow fire as opportunity offers.

Perhaps we may find a partial explanation of the sort of distrust which the Germans show for the *rafale* in the shortcomings of their equipment.

The delivery of rapid fire entails the use of the trail spade. Now the disadvantages of this arrangement, which have been noticed in the German equipment, are remarkably aggravated in this nature of fire. This is the meaning of the statement that the German gun is not a true quick-firer, but only a gun which can fire rather quicker than the old ones.

The increased rate of fire has made no difference to the Germans in their system of ranging or fire discipline. Their instructions on these points are not uniformly symmetrical, and at first sight the drill-book seems to be made up of a large number of special cases. But, thanks to their continuity of system, officers are enabled to make themselves familiar with all these cases, and

have no hesitation in applying them. Thus a remedy is close at hand for the evil which results from too complicated rules.

This complication, though more apparent than real, is, as a matter of fact, intentional, in proof of which I need only quote the following lines, taken from the introduction to the instructions in fire tactics: "The Manual confines itself to treating of situations which most often present themselves on service. In any special case that may arise the general principles enunciated are to be followed, and not the strict letter of the procedure enjoined. Every favourable circumstance is to be made use of to obtain the desired effect as quickly as possible."

The drill-book, scrupulously adhering to the spirit which pervades all German regulations, defines the object, indicates the means, and leaves to the battery commander the whole responsibility of applying the means. This is equivalent to saying that the system of fire discipline must be capable of application to all circumstances; that it cannot be uniformly simplified; and that the battery commander must be given a free hand, unfettered by narrow-minded restrictions.

Thus the Germans, who differed from the theory that we have demonstrated above as regards the two principles of the *rafale* and distribution in depth, are at one with us when—and this is a point I wish to emphasise—it is a question of the elasticity and adaptability to be given to the system of fire discipline.

INDIVIDUAL FRONTAL POWER OF THE QUICK-FIRER.

The power of the *rafale* from a quick-firing gun is said to be so great that it produces annihilation throughout its area of impact, or, at any rate, puts the opponent entirely out of action if he is

not under cover. So to continue firing would be wasting ammunition on the killed and wounded.

If the enemy is more or less under cover the first *rafale* will have a varying effect in proportion to the degree of cover available for his men, but not far short of the maximum obtainable. The succeeding *rafales* may still do some damage, but it will not be long before the expenditure of ammunition will be out of all proportion to the result obtained if we eliminate those that have already been hit.

In other words, according to this view, the *rafale* may be taken in theory at least to produce the maximum effect on a target equal in front to its own width, and it would be no use trying to do more on account of the waste of ammunition.

The width of the *rafale* depends on the width of the cones of dispersion and the organisation of the series; from the shape of the cones and the usual intervals between the guns it is generally wider than the front of the battery. By battery must here be understood the grouping together of a certain number of guns. This number may be reduced to one; the minimum width of the *rafale* is in this case that of the cone of dispersion itself.

Let us then suppose, to make it quite clear, that a battery produces a *rafale* 100 yards wide. Admitting the foregoing theories, there would be no use in opposing more than the one battery to a target 100 yards wide. To collect a larger number of guns against this target, whatever its description, would be not only a work of supererogation but a distinct mistake, for it would mean engaging, exposing, and neutralising a body of artillery, and wasting ammunition all to no purpose.

These different theories as to the employment of

the *rafale* have been crystallised in the shape of axioms:

(i.) Rapidity replaces concentration of fire.

(ii.) Fire, from being convergent, has become divergent.

(iii.) The number of batteries to use against an objective is solely determined by the extent of front to be attacked; to each battery must be assigned a portion of the target equal in extent to the width of the *rafale*.

But these deductions, very seductive, to be sure, are too arbitrary. They virtually declare that one quick-firer can take the place of five or ten ordinary guns, other things being equal as regards the power of the projectiles, because its rate of fire is five or ten times greater.

Now this statement is really quite inaccurate, for it presupposes no hitch in the working of the guns, and does not take into account the incidents and accidents of the fight. Where one of the five or ten ordinary guns ceases fire, or is temporarily out of action—a common enough incident at practice, and one which will happen even more frequently on service—the result will be a diminution of fire effect by one-fifth or one-tenth. But where the single quick-firer fails, fire effect will be reduced to zero.

Without doubt the individual frontal power of the quick-firer is a new factor which forcibly impresses the imagination. Doubtless the artillery, which means to make the greatest possible use of its new weapon, will not put more guns in line than necessary to effectively beat its opponent. Every one agrees on these two points, but the difference of opinion begins when it is a question of calculating the number of guns that are necessary.

It is impossible not to take into consideration also the nature of the objective, as well as its extent of front. Can it be said that a line of infantry 100 yards long, standing up, which a single *rafale* would knock over, can be compared to the edge of a village 100 yards in extent, against which both time and percussion shell must be used at the same time?

Following the same train of thought, let us take the case of an objective made up of a collection of sub-objectives, separated by more or less extended intervals. The effect of these intervals may be such as to modify the number of guns required to act against such a front. The case will arise, as we shall see later on, when, instead of attacking the whole front simultaneously, it will be better to engage each sub-objective separately.

In all cases, when calculating the number of guns to be brought into line against any specified target, it is essential that the working of the machinery of the *rafale* shall be absolutely assured, "so that the requisite effect may be produced with certainty in the time desired. We must not reckon on any firing device, such as the 'spreading motion'[1] for instance, which, though very useful under some circumstances, is apt to produce wrong impressions."

LANGLOIS, Vol. I. p. 412.

With these exceptions we shall see, with regard to the employment of artillery in the fight, that the quick-firers' individual power can, and should, be taken into account.

[1] *Fauchage*—the mowing effect produced by giving a couple of turns to the traversing wheel after each round. (TRANS.)

CHAPTER II.

GENERAL CONSIDERATIONS AFFECTING THE ACTION OF ARTILLERY.

Action behind cover—Action in the open.

THE OPERATION OF LAYING INDEPENDENT OF GUNS BEING BEHIND COVER.

For more than twelve years the indirect fire of field artillery has formed the subject of assiduous study and many experiments, it has also given rise to very keen controversy.

The adoption of indirect fire meant bringing batteries into action behind cover.

The novelty of the idea impressed many people, who were much struck with the increased power of the weapons then in use[1] and especially of the forthcoming quick-firers, but tradition was against them.

Without the experience of war it was evident indeed that, with quick-firing guns, combatants would be

[1] Experiments were carried out about 1890-91 at Poictiers, in order to compare the effect of 4 pr. projectiles fired by the 80 mm. gun and that of the 90 mm. shrapnel. They showed that the proportion was 1 to 60, in other words, that after the range had been found, other things being equal, the effect obtained with the shrapnel in one minute was equal to that obtained by the 4 pr. in one hour. (The fire effect of the 4 pr. shell from the 80 mm. may be compared with that of the German guns used in 1870.)

obliged to seek cover at all costs from the terrible effects of these new weapons, under pain of complete annihilation.

The objections raised to this way of thinking were of two kinds, moral and technical.

The first has nothing to do with equipment or the nature of the ground, and can easily be reduced to its right proportions. It is certainly true that in many cases during the course of an action it may be necessary for artillery to expose itself in the open in order to give effective support to the other arms alongside it. But just as often, particularly in the earlier phases of a fight, it must conceal itself in order to fulfil its mission, which is to assist the troops in its vicinity and not to court destruction without an object.

The value of such arguments is, therefore, entirely a matter of circumstances.

The objections of a technical kind are essentially a question of *matériel*; they are closely connected also with the impediments which the nature of the ground presents to effective fire. In any case they depend entirely on the improvements in laying mechanism and arrangements for utilising auxiliary marks.

Very soon a reaction took place. A current of opinion was shortly started in favour of indirect fire, and certain officers even went so far as to wish to make it the normal procedure in cases where ordinary common sense should have rejected it. It is without doubt this dangerous exaggeration which inspires the sort of distrust with which this method of field artillery fire is looked upon at the present time.

In the Imperial German Manœuvres of 1897 indirect fire was not once employed. In certain French corps indirect fire at manœuvres used to be forbidden. There

are still to be found in the French and German drill-books restrictions evidently due to this suspicion.

French F.A.D. § 426.

"As regards security," says our drill-book, "it is advantageous to make use of a ridge to hide all or part of the artillery from the enemy's view. At the same time the use of the crest line to hide batteries is only admissible in cases where the tactical situation does not require fire to be directed on the forward slope."

The German regulations are more categorical than our own.

German F.A.D. § 289.

"Direct fire is the rule," they state; "indirect fire is made use of when the tactical situation or the nature of the ground requires a position to be taken up behind cover. In some cases, indirect fire may make it possible to cause loss to the enemy without revealing one's strength or exposing oneself to hostile fire."

But first of all we must have a clear idea of what is meant by indirect fire. The definitions given of it are far from being precise, and differ very much in their various meanings. It is, therefore, not to be wondered at that discussions, starting from different premises, do not evolve any simple principle for the guidance of artillerymen when confronted with the concrete problems of reality.

DEFINITION OF INDIRECT AND DIRECT FIRE.

According to our drill-book, when neither the layer nor the section commanders can see the target, owing to the battery being covered by the ground in front, fire is called "indirect."

In the words of the German regulations, "indirect fire is carried out when laying for direction has to be done by means of auxiliary marks."

Let us, then, suppose a battery, in sight of the target,

in position on a crest, or in front of the crest, firing for some reason or other with auxiliary marks. By the official definitions this battery's fire would be indirect in Germany, direct in France.

Let us suppose that the same battery, after retiring behind the crest far enough to conceal a man standing up, fires with correspondingly increased elevation. If the layers aim directly at the target the French would call it direct as well as the German, but if they use an auxiliary mark it would be direct fire in France, indirect in Germany. Finally, it must be remarked that the German definition does not legislate for indirect laying other than that with auxiliary marks.

These anomalies and discrepancies result from the confusion of the means and the end. The means is essentially a technical matter, that is, the operation of firing; the end is exclusively tactical in character, namely, provision of cover. The operation of firing depends specially on the facilities afforded by equipment; but cover has to do with the nature of the ground.

It is evident from all this that it is not possible to confine such conflicting elements within the limits of a single definition; besides which it is easy to realise how naturally this confusion has arisen in proportion to the improvements in *matériel*.

With the artillery of former times, both smooth-bore and rifled, there could be no question of laying a field gun otherwise than by aiming it directly at the target. Indirect fire was that in which the layer, in order to see the target, was obliged to raise himself above the gun. Its employment necessitated an outfit of pickets, laying cords and slide rules, and required some sort of permanent installation; so this kind of fire was exclusively reserved for siege and position guns.

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In consequence, the expression indirect fire came to be considered as meaning that the guns were defiladed behind a covering mass of some sort.

When, after the war of 1870, it was thought advantageous for field guns to practice indirect fire, it was first of all limited to extending to field artillery the methods in use by siege batteries. The theory of applying indirect fire to field guns was right enough in itself, but its application raised well-founded objections.

Meanwhile *matériel* had been perfected in all its parts. The sights of the 90 mm., by means of a suitable motion of the deflection leaf, allowed the gun to be laid on the target while the aim was taken in a different direction; this was laying with an aiming point or auxiliary mark. The calculation of angular distances [1] in millimetres of deflection became the basis of all laying for direction, including auxiliary marks, pointing out, distribution and change of targets. In consequence of auxiliary laying the spirit-level showed itself far superior to the tangent sight as a means of giving elevation.

Laying with auxiliary marks formed part of the process of indirect fire, as the aim was not directly taken at the target. Besides this it was independent of defilade, and several battery commanders made use of it generally without regard to the position of the guns relatively to the covering crest.

Thus it came about that in many cases indirect fire was carried out when the layers could see the target. This idea seemed absurd to many minds, and encountered

[1] Officers can rapidly make these calculations by means of a ruler held at arm's length, or by graduation in the field of the telescope, or, more simply still, by measuring with their finger-joints or hand. (*Revue d'artillerie*, June, 1899—March, 1900.)

an amount of opposition and scepticism that was difficult to overcome. It was, nevertheless, beginning to make headway generally when the progress realised in laying apparatus and means for auxiliary laying compelled its adoption.

In this manner the separation of the process of laying from the defilading of the guns was completely established.

To be precise, the expressions direct and indirect fire cannot have the same meaning to-day as heretofore, without producing misunderstanding and erroneous impressions. They should be abandoned and replaced by those of direct and indirect laying, which imply nothing but a visual process quite apart from firing, independent also of the position of the guns with regard to the covering crest. The position of the latter may be defined by the expressions "masked" fire and fire in the open.

These two questions of laying and defilade, or cover, though in some degree related, differ from each other, and must be considered from essentially different points of view. The former is, as we have already said, a technical question, the latter is entirely tactical.

The nature of fire, whether masked or in the open, may be decided either by the ground or by circumstances. If the course is imposed by the ground there is no more to be said; as regards tactical considerations, we shall have occasion to examine them later. We will but pay attention for the time being to action behind cover, the advantages and disadvantages which it presents, as also the degrees of defilade which may be employed. Finally, we will examine the methods of laying which apply to such cases.

We will then consider action in the open from a similar point of view.

DEGREE OF DEFILADE.—We know that a battery, so as not to disclose its position by the flash of discharge, must be placed about 13 feet below the covering crest.

As we shall see later, with regard to laying from behind cover, it will generally be easy to realise such conditions; if a greater amount of defilade can be obtained than 13 feet, the battery will be all the more secure.

At the same time there are practical limits to the defilade obtainable, and not very extensive ones, which are the outcome of two different causes, namely, (1) the exercise of control by the battery commander; (2) the clearance of the covering crest by the projectile in its flight (in cases where the cover is not given, by crops or other substance which it can traverse without exploding).

EXERCISE OF CONTROL BY BATTERY COMMANDER.

Any officer who has once had command of a battery will agree that a battery commander can only control the *personnel* and working of his battery as long as he is in close enough proximity to be heard by all. This necessity is far more marked with quick-firing guns than before, and if it is the case at practice, what will it be on service? Now the battery commander must be able to see the target; the extent of cover available will, therefore, depend on the height from which the battery commander is able to observe in the battery or its immediate neighbourhood. If no better means presents itself he will mount on a wagon.

Theoretically, it is enough for the battery commander to see the target; but in practice it is essential that he should be able to see more or less of the ground in front of the target, to observe ranging rounds that are short, and also to continue firing should the objective

make any forward movement. For this reason the battery commander, and therefore the battery, will not be able to avail themselves of the extreme amount of cover afforded by the place from which observation is carried out.

CLEARANCE OF THE CREST.—This restriction is not so narrow as the preceding one, but must, nevertheless, be considered. Without going into a discussion on this point, which will be considered later, we will content ourselves for the moment with observing the following fact:

When firing at long or medium ranges, even when the battery is some way below the crest, there need be no fear of the projectiles striking the crest, especially if the angle of sight is positive—that is, if firing uphill.

On the other hand, at short ranges, shell will catch the crest if the guns are some distance down the reverse slope, especially if the angle of sight is negative—that is, when firing downhill.

In practice an apparently insignificant accident of the ground is enough to catch a projectile. In the course of some recent experiments on a range where the ground was not at all broken, although the position was not far behind the crest (there being only sufficient cover to hide a gun or man on foot on a slope of $\frac{1}{100}$), rounds could be seen striking the crest, which showed just a little rise in front of the gun.

It was only necessary to move the gun a few inches to enable it to continue firing; but to do this a very vexatious manœuvre had to be carried out at the moment of opening fire. Besides this, the projectiles bursting on the backs of the infantry in front would have had a most regrettable moral effect, even if not much actual damage was done.

From the very fact of a battery being in action behind a ridge, any infantry in front of it is either in a hollow or on a ridge further off. In the first instance it is in complete security, in the second, it will be out of reach of bullets or splinters from shell bursting prematurely near the muzzle.

To sum up, looking at the question from the technical or executive side only, leaving out all questions of tactics and the different degrees of cover for guns, we may draw the following conclusions:

Firing from behind cover is feasible when the target is stationary, or cannot advance beyond the ground which the battery commander can see, and further, when there is no likelihood of rounds striking the covering crest.

Speaking more generally, it may be said that the great disadvantage of firing from behind cover is the impossibility of bringing fire to bear on hollows or the forward slopes. This remains the practical limitation to coming into action behind cover at the present day, notwithstanding the vital importance of cover, or the wonderful facilities for indirect laying given by the improvements in laying apparatus.

Different Degrees of Cover.—From the point of view of fire-action and the manœuvring by which guns are brought into their firing positions, there are four different degrees of cover:

(i.) Cover for guns, 3 feet 6 inches below the crest.
(ii.) „ „ man Standing, 6 feet below the crest.
(iii.) „ „ horses, 7 feet below the crest.
(iv.) „ „ mounted men, 8 feet below the crest.

It must be remarked that in some instances it will be a case of getting cover not only from the opponent, who may be more or less hidden himself, but from the ridge

that conceals him, or the observing station used by the enemy.

The evolutions of manœuvre have in themselves no connection with the actual process of firing. Nevertheless, they cannot be neglected when determining the amount of cover necessary, for the drawbacks of a manœuvre which gives a certain degree of cover may more than counterbalance the advantage to be gained.

There is a description of cover not mentioned in the drill-book which is, nevertheless, excellent when it can be found, namely, the cover given by a ridge, or other mass, in advance of the position.

FIG. 4.

FIG. 5.

To open fire from such covered positions as these, batteries are brought into "action front," inverting the more usual method of coming into "action rear."[1]

The procedure laid down in the German regulations bears the greatest resemblance to our own, whether the battery is brought into action in line or from a flank, whether the movement is performed mounted at the trot or dismounted at a walk, or whether the guns are halted in the positions from which they are to fire or run up by hand after unlimbering, by means of man-harness or drag-ropes, etc.[2]

[1] The normal method of the French artillery is to come into "action rear." (TRANS.)

[2] The experiments made by the 16th Regiment in 1899 at the Bourges practice range showed that the four-wheeled vehicle

The only fact that interests us is the difficulty, nearly always a serious one and sometimes insurmountable, which is experienced in running up by hand guns and wagons when packed as for service, on any ground other than a drill field, no matter what devices are employed.

On a steep slope movement is impossible; on a gentle slope the distance to be travelled in running up from one degree of cover to another is considerable, as may be seen from the accompanying diagram.

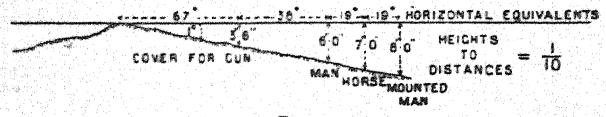

FIG. 6.

Diagram showing distances in rear of crest of the different degrees of cover for a slope of 1°.

The horizontal equivalents show the distances which the gun has to be run up from the point where it is unlimbered.

When there is an angle of sight,[1] either negative or positive, it has the same effect on the amount of cover

formed by hooking the gun to the wagon* body, was easier to move thus than separately. On an even surface of turf, with a gentle slope, seven men were enough to run up the two carriages, joined as above; in heavy, broken, or steeply sloping ground, recourse had to be had to horses (one or two pair led dismounted).

[1] In ordinary ground the angle of sight varies from one-half to two centièmes; the angles of sight of the artillery positions on the battlefield of Gravelotte-St. Privat are approximately these.

* The French unlimber their wagons in action, placing the wagon body close alongside the gun. So if a battery halts in rear of the crest, the wagon bodies have to be run up by hand as well as the guns. (TRANS.)

obtainable as an increase or decrease in the slope of the ground, corresponding exactly to this angle.

In the subjoined figures A and B are the covering crests; a' a', b' b' are the observers placed behind crests A and B respectively.

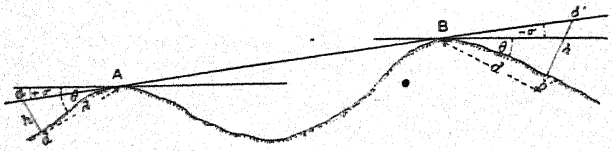

FIG. 7.

Let θ be the slope of the ground.

σ the angle of sight + or —.

d the distance of the observer from the covering crest.

h the observer's height above ground level.

It is easily seen that the following formula is true:

$h = d \tan (\theta - \sigma)$, in which σ must be taken with its proper sign.

In other words, commanding positions increase the protection and allow of guns being run close up to the crest; positions that are commanded have the corresponding disadvantages. On the other hand, positions that are commanded, but under cover, have the advantage of allowing an observer to see more ground in front of his target than commanding ones similarly situated.

When a difference of level exists, the line of defilade s not necessarily the highest crest line. It is situated between the latter and the observer in the case of a position that is commanded, and on the enemy's side of the highest crest if it is a commanding position. For

instance, in the case of a commanding plateau the line of defilade is the forward edge of the plateau. The observer can be under cover when standing on the top, even if this slopes towards the enemy, if the angle of sight is sufficiently greater than the slope of the ground. The above formula may be applied, giving θ a negative value.

However, we must not exaggerate the importance of these theoretical considerations, for in reality things are not so simple as all this.

The contours of the ground are not mathematically precise. The slopes are not uniformly regular, and crests are formed of alternate curved and flat surfaces, which completely modify the conditions of defilade. It is, nevertheless, possible to make a rough estimate of what is likely to happen in action, and of the points to which executive officers should direct their attention.

Any officer who has manœuvred in broken ground, such as will form the battlefields of the future, will recognise the fact that, except on more than ordinarily favourable ground, or under very special circumstances, it is of the greatest importance to do away with running up by hand as far as possible. With this remark we will resume the study of the different degrees of cover.

We have seen that the Germans consider direct laying the fundamental principle of fire tactics. The only solution of the problem, once this principle is admitted, is that of getting cover for the guns only; this, indeed, is what the Germans consider the normal procedure.

This way of doing things, however, entails the greatest amount of running up by hand. It has, as we shall see later, all the most serious disadvantages of

firing from behind cover while giving the least amount of protection obtainable from this method of action.

This preference of the Germans for taking as little cover as possible may, perhaps, be regarded as a remnant of the practice, which they always followed till a year or two ago, of coming into action in the open only. They have recently made concessions in this direction by adopting the system of firing from behind cover, which is provided in their new regulations. Thus in the recent Imperial manœuvres of 1899, positions were taken up out of sight of the enemy, contrary to the practice observed in former years.

General Rohne has written some very interesting articles on this question of firing from behind cover, showing exactly how the question stands in Germany. The General does not minimise the difficulties to be met in taking up a position only just far enough down the reserve slope to cover the guns; and he gives several hints as to the way in which these difficulties are juggled with at manœuvres, which may console us for the exhibitions we sometimes see at home.

"All positions behind cover," says he, "are of the greatest importance when first coming into action. The guns should be placed so far behind the crest that the guns themselves can just be laid on the target, or that the latter can be seen by the layer standing up. In this way one may depend on the laying (if necessary, a gun may be run up further to take the angle of sight), and the enemy has more difficulty in locating the battery and observing the effect of his fire.

"If it is desired to take up a position out of sight of the enemy, that will allow of direct laying, certain difficulties have to be faced. These arise from the fact that there is only one possible emplacement for the

guns, that satisfies at the same time both the requisite conditions: a sufficient amount of cover, and a view of the target over the sights.

"This way of occupying a position should be constantly practised. So I am going to draw attention to a mistake which, as far as my experience goes, is generally made.

"As a rule, the positions in question are immediately behind a ridge or some rise in the ground. While attempting, quite rightly, to come into action out of sight of the enemy, the battery is generally unlimbered too soon, so that in difficult ground the guns reach their actual emplacements one after the other. Often enough one gun is run up by using the detachments of several others, at the cost of superhuman efforts and much loss of time. Then, at manœuvres, an effort is made to conceal this mistake by opening fire with the one gun that is in position, thanks to the efforts of the whole battery. Such a fault is inadmissible, and on service would have the most disastrous consequences, for it would bring the enemy's fire upon one when least able to reply."

This practice of having the guns only just concealed, which is the normal one in Germany, and was highly esteemed in France a short while ago, is to my mind the worst way of coming into action behind cover, except in special cases. It comes of being mesmerised by the mania for direct laying, which possesses the Germans. Now, we know that with good laying apparatus the question of direct or indirect laying is a matter of perfect indifference.[1]

[1] The author is here referring to the admirable facilities which the present French equipment undoubtedly possesses for laying behind cover. (TRANS.)

A point far enough back to cover a man standing up has many advantages as a firing position. The battery commander needs no special look-out place, and has only to advance a few paces to see the ground well, while still remaining in close contact with his battery. The subalterns can see the target, the ground, and what goes on there, and can easily take the battery commander's place should anything happen to him; lastly, from the point of view of manœuvre, there is very little running up by hand to be done.

The further back the battery goes the better protection it will gain, and the less man-handling there will be; but the battery commander will require a special observing-station. When the distance below the crest is sufficient to cover a mounted man there is no man-handling, and even when 10 feet below the crest the battery commander can use a wagon as his observing post. We have seen the disadvantages which result from a position too far below the crest.

In weighing the advantages and disadvantages of the different degrees of cover, it appears as if a position from 5 to 7 feet below the crest would be the most favourable as a rule.

Practically in this case there is little or no man-handling to be done; while, as a matter of fact, experience goes to prove that a battery trotting into action right or left behind a ridge, even if the drivers' bodies are half visible, forms such a fleeting target that the enemy will either not perceive it at all, or will be unable to form any idea as to the actual position of the battery.

This by no means debars other positions from being selected if necessary. It will depend not only on the ground occupied by the battery, but also on the target,

the ground held by the enemy or which he may occupy in the future, the position of neighbouring batteries, etc. . . . In a long line of artillery the degree of cover will vary greatly, from positions quite in the open to those affording the maximum protection obtainable.

In practice it is, indeed, not a case of concealing one point from another, but one line from another line—which is mathematically impossible. All that can be done is to ensure the concealment of the greater part of the line while keeping it as regular as possible, so that, after fire has been opened, changes of target may be carried out through wide enough angles.

It is understood, of course, that we are speaking of concealing a line of artillery that has been fully trained; but special attention should be directed in training them to making the drivers and detachments careful not to show themselves more than obliged. The drill of the different evolutions must be familiar to the whole *personnel* (which is what General Rohne expressly lays down), and strictly followed.

LAYING.

When first a gun is laid on coming into action the degree of cover obtained may vary very much. Without going into technical details regarding the means employed, it will be enough to remember that there are two principal methods—direct and indirect laying.

Direct laying from behind cover, so much in vogue among the Germans, has many serious drawbacks. Indeed, if the target alters its position, or if a new target appears in the area unseen from the position, either the battery must be brought nearer the crest—always a long and dangerous operation—or recourse must be had to indirect laying. This will result in confusion, perhaps at the critical moment, or anyhow

in a sad loss of time. It would have been better to begin with indirect laying.

By mounting men on some part of the carriage, or wagon, indirect laying with an auxiliary mark can be carried out from a position 10 feet or more below the crest. It should be noticed that in indirect laying the degree of cover is reckoned as from the aiming point or auxiliary mark, and not from the actual position of the target; so if the aiming point is situated above the target, which is usually the case, the battery is still further out of sight of the target itself than of the aiming point.

The ground on the battlefield of August 18th (Gravelotte) slopes generally down from east to west, and all the French artillery positions commanded those of the Germans. They comprise both gently-rounded crest lines, as between St. Privat and Roncourt, with spurs as at Amanvillers, and a plateau such as that of Point-du-Jour.

It was unnecessary for the German artillery, crushingly superior as it was in numbers and weight of metal, to conceal itself. It came into action everywhere in the open without paying attention to the protection obtainable from the ground.

The French gunners tried to make up for their inferiority by utilising the cover given by the conformation of the ground, which favoured them wonderfully. It is most remarkable in this respect that the French batteries throughout the whole extent of front were able to take similar advantage of the ground.

In the centre the French artillery, placed on the heights of Amanvillers, opposite the IX. German Corps, "was difficult to reach, not only from its commanding position, but because it was under cover behind walls or other obstacles." G.O.A. p. 676.

To the north the batteries of the 6th French Corps, after advancing down the slopes of St. Privat, were very soon obliged to retire behind the crest again.

"In this position the Prussian guns of the Guard Corps could scarcely reach them from the hollow in which they were placed."

Ibid. p. 715.

To the south, when the artillery of the VII. and VIII. German Corps was in the act of deploying by Gravelotte, "the enemy, with his guns well behind cover, near Point-du-Jour, lost no time in replying with a very heavy fire."

Ibid. p. 741.

The guns which the French artillery possessed in 1870 did not allow of properly concealed action; still, the judicious use that it was able to make of cover shows the important advantages to be derived from it to-day under similar circumstances.

ACTION IN THE OPEN. Just as before, a position in the open may be necessitated by the nature of the ground or the tactical situation. But in such cases rapidity of movement must up to a certain point compensate for the want of protection, and drill must be adapted and practised with this idea. Indirect and direct laying will both be employed in the open, according to circumstances.

The former will apply to batteries which are more or less stationary, when told off to remain in observation, that is, when they have to engage any targets that may appear in different parts of the field, and which may not be plainly visible. Indirect laying in this case affords special facilities for pointing out and changing targets, as well as for the distribution and execution of fire.

Direct laying is the rule against targets at short ranges, which can be plainly seen, and especially when fire is to be commenced immediately on taking up a

position in the open; each gun then fires straight to its front at the portion of the target opposite to it. At close quarters, and in the open, the moral element is a factor of the greatest importance, to the exclusion of all others. It would be both useless and dangerous at such a moment to run counter to the promptings of instinct, which will swamp everything else.

CHAPTER III.

GENERAL CONSIDERATIONS AS TO FIRE TACTICS AND FIRE DISCIPLINE.—ACTION AGAINST DIFFERENT OBJECTIVES.

SERVICE PRACTICE.

We have seen that the system of fire discipline should be such as to give the battery commander a weapon applicable to every possible situation that may arise on service. It is the battery commander who is solely responsible for the executive control of fire, and it is his business to turn it to the best advantage.

These duties, which vary not only with the description of target, but with the nature of the ground and the tactical situation, constitute what are known at practice camps as fire tactics, and which become fighting tactics on the battlefield.

The idea of practice being carried out in accordance with a tactical scheme is comparatively new in France, at any rate in official documents. Yet it has become a question of great importance since smooth-bore days, owing to the increased power of the long-range weapons in use and the various combinations essential to efficiency on service.

Here, again, we have to guard against being carried to extremes.

It must not be forgotten that the *sine qua non* of tactical efficiency is, in the first place, a thorough grasp of executive detail. In criticising the procedure at practice camps, *à propos* of the doctrine of field artillery fire, we were of course thinking of its actual application to the battlefield, and not of the methods of instruction. These must be as scrupulously minute as before, if not more so, in proportion to the improvements in equipment and the increased power of the arm. It is above all essential that every man in the battery, from the commanding officer to the last-joined gunner, should be thoroughly trained in the drill and technical difficulties of fire discipline.

The German manual carefully lays down from the very first page, to avoid all misunderstanding, the essentials of efficient fire action.

These are:

"Smart drill.

"Strict fire discipline.

"Tactics appropriate to the object in view."

Neither of these conditions must be sought to the detriment of the remainder. First comes instruction in the drill, or technical part of the training, which must be given in detail with the greatest precision; then the wider application of drill, or tactical training. The latter is absolutely indispensable to the former, but we must remember that it cannot exist by itself.

FIRE EFFECT.

The fundamental principle of fire action is that the results obtained should be commensurate to the amount of ammunition expended. I say purposely results, and not effect.

Destruction is, indeed, only a means to an end. The end in view is to beat the enemy, and is sometimes to

be gained by means of comparatively small material results or "fire effect."

To destroy him is, of course, the surest way to beat the enemy, when it is practicable to do so. But it cannot be the only one, for, as was said in discussing the effect of projectiles, however powerful the guns in use may be, it is often impossible to destroy the enemy, if he knows how to utilise the ground.

When in action with the object of destroying *personnel*, it is only logical to fire when there is a chance of the fire being effective, that is, when the enemy can be reached by artillery fire. With a smart opponent these moments will be fleeting, so the action of artillery must be directed not only towards material fire effect, but also with a view to getting useful results by its menace, or moral effect.

ACTION AGAINST DIFFERENT OBJECTIVES.

THE VARIOUS NATURES OF OBJECTIVES.—What are the objectives which field guns may have to engage? "They are of every kind," rightly answers the German drill-book, "except those that are protected by substantial cover." The latter is the business of heavier guns, which are beyond the scope of this work.

German F.A.D. § 287.

These objectives are most varied, comprising animate targets grouped in different formations, such as infantry, cavalry, etc., or inanimate *matériel*. They may further be "certain areas of ground, sufficiently limited in extent, where the enemy is known to be for certain."

French F.A.D. § 421.

But it is not only the targets existing at the moment, whether visible or not, that artillery has to engage. It has the further strict duty, during every phase of an action, of thinking about targets that may appear later, and must take such steps as will ensure their being dealt with as effectively as possible. Such

is the spirit of the principles laid down by our drill-book, in imposing on the higher artillery commanders the duty of "carefully watching the scene of action." French F.A.D. § 462.

To facilitate expression, we will call this special action, which is to take effect eventually, by the name of "observation action." The apportioning of the target is "the first step by the higher artillery commanders in the exercise of fire control." This is an action of capital importance from the consequences it may have on the combined results obtained. Now, whatever the nature of the target may be, its apportioning must be carried out in accordance with the same principle; it must be based on the extent of the enemy's front, whether it is a case of destroying an animate objective, demolishing an obstacle, or standing by to sweep a certain space of ground. *Ibid.* § 449.

This principle does not appear to be sufficiently clearly indicated in either the French or German regulations.

As regards the choice of objectives when several exist at the same time, that is a question that belongs to the sphere of tactics, and will be considered when dealing with the fight. But it may be said at once that, "regardless of possible losses, that target should be engaged which in each stage of the fight is the most vital." German F.A.D. § 312.

These general principles being admitted, we will try to apply them to the different objectives that may occur.

ACTION AGAINST INFANTRY.

INFANTRY IN THE OPEN.—A body of infantry standing up, either halted or in motion, cannot show itself in open ground within range of artillery fire, under pain of more or less complete annihilation. This axiom results

from the investigations previously made as to the power of the quick-firer. But the range at which its fire effect will be sufficient to shatter a determined body of troops must necessarily depend on the strength of the latter, its formation, and the degree of visibility, etc. It is impossible to lay down anything precise with regard to this.

According to the instructions current in Germany, under 3300 yards it is inadmissible for detachments of infantry equal in strength to a company to remain in the open under artillery fire, unless the latter has suffered severely or is itself under the fire of the hostile guns. Former regulations admitted of ranges of 2700 and 2200 instead of 3300 yards.

German F.S.

On August 18th, the VIII. German Corps was assembled round Rezonville. Hearing the canonade of Verneville on his left, the work of the IX. Corps, General von Goeben directed the 15th division on Gravelotte. The appearance of the heads of the Prussian columns on the plateau of Gravelotte drew the fire of the French batteries in position within easy range (2200 to 3300), on the plateau of Point-du-Jour, across the La Mance ravine. The Prussian infantry were able to carry out the movement without serious loss. Had our artillery, even though numerically weak, possessed quick-firing guns and known how to use them, such a manœuvre would have been impossible, or carried out only at the cost of enormous losses.

This is a point that has gained in importance, and will have to be carefully considered in moving bodies of infantry of any strength on open ground.

How is artillery to engage a body of infantry that comes within effective range, either in the deployed formation which is the German method, or in small

columns, as enjoined by the French regulations? Will it be better, supposing the number of guns at our disposal too small to allow of engaging the whole front of the target with the maximum intensity of fire, to distribute our fire over the whole front with lesser intensity, or to concentrate the heaviest possible fire on certain portions, neglecting the remainder of the target?

Both methods would probably inflict the same amount of casualties; but, in the second case, the losses suffered by certain portions would mean annihilation, or at least disorganisation, of those parts, and the moral effect would put the whole line out of action. This result would probably not be obtained by distributing fire equally over the whole front. The centre of the line is the important part to crush.

Infantry advances in several lines; the first thing necessary is to bring it to a standstill. So "artillery will direct its fire on the most advanced line, unless bodies in close order behind offer a specially favourable target." German F.A.D. § 312.

When infantry comes within the zone of effective artillery fire, it can only escape the destructive effects of the *rafale* in one way, by lying down. Then, unless the ground is absolutely bare, it is practically out of reach, especially if the men do not raise their heads and shoulders to fire.

What course is, then, open to a gunner when confronted with the impossibility of destroying this infantry? Why, he must paralyse it; he must disarm it; so that his own infantry may be able to advance. He will gain his object if the hostile infantry is forced to lie flat with its nose to the ground, cowering under the constant threat of a storm of shell to be let loose on him at the slightest movement.

If, by roughly ranging, the infantry while advancing has been bracketed within the limits of the *rafale*, the object is practically attained. But if not, the artillery must not persist in laboriously ranging on detachments picking their way in separate groups, and visible only from time to time.

This would be running the risk of wasting both time and ammunition, and of letting the hostile infantry get within rifle range. It must make up its mind at once, and get the range by trial shots of a portion of the ground over which the enemy has to pass in his advance. Any infantry that reaches this fire-swept zone will be imprisoned there, powerless, and will be unable, without exposing itself to the risk of disastrous loss, either to advance, retire, or use its rifles.

I am speaking here, of course, of a combined movement, and not of the isolated action of a few energetic detachments. This interpretation of the use of artillery fire is only the application to a special case of the following general principle, promulgated by our Field Service Regulations. "Paralyse and wear out the enemy by keeping him in constant dread of a decisive crisis."

French Field Service Regulations, § 128.

It was in this way that the Boers used their rifle fire at close and medium ranges. The results they obtained give some idea of what the effect of artillery *rafales* would be at long ranges.

When the English infantry entered a zone swept by the Boer rifles it was forced to halt and lie down Every further attempt either to advance or retire was at once checked by the fusillade again let loose.

The Boers were careful of their ammunition at the battle of Modder River, (November 28th, 1899), but, on the other hand, at the slightest movement among the

English troops "the hail of bullets began again as hard as ever, regardless of the range." FROCARD and PAINVIN, p. 293.

At the battle of Colenso (December 15th, 1899), the leading battalions of Hart's brigade advanced over open ground swept by Boer projectiles, both small arm and artillery. They lost men at every step, and as they got near the river, the Boer fire seemed to redouble its intensity: "Every time a company got up to advance the crash of the musketry became simply awful." *Ibid.* p. 223.

At the same battle of Colenso a squadron of the Imperial Light Horse, under the orders of Lord Dundonald, had dismounted and was advancing in open order, when it was surprised by a volley of musketry at only 600 yards and obliged to lie down. The *Natal Advertiser* in reporting the incident adds: "The men of the Imperial Light Horse were lying flat and perfectly motionless, and the Boers thought this squadron was annihilated and ceased firing. But when the English tried to rise, the enemy found out their mistake and reopened a vigorous fire. Finally came the order to retire, but for two hours it was impossible to carry out the movement, from the heavy fire which the republicans opened on the English soldiers every time the latter attempted to move. However, the 7th Battery, by placing several well-directed shells, managed to cover the retreat. But during the movement the troops suffered pretty severely."

The Boers, indeed, made a practice of "registering" zones. "On the plain south of the Modder (action of November 28th) the ranges had been registered by a series of white stones, which were clearly visible for half a mile." FROCARD and PAINVIN, pp. 228, 279.

As regards the conduct to be pursued by infantry when exposed to the *rafales* of quick-firing artillery, it

would be out of place for us to express an opinion. That question is beyond the realm of artillery tactics, and concerns our comrades of the infantry, who should note the main features of artillery action and adopt whatever measures they think best. But here are a few hints which they may find useful.

We have already seen that, looking at vulnerability from a theoretic point of view, formations in small columns are preferable to linear ones, owing to the protection given by the front rank men to those in rear of them.

For the same reason it is advantageous to dispose these columns in such a way that not more than one at a time may be caught in the effective radius of the same projectile (150 to 250 yards deep, by 20 to 25 wide).

If the interval between the columns is appreciably greater than the width of the cone of dispersion, it will be necessary to tell off each gun to fire at a separate column instead of distributing a *rafale* of uniform intensity over the whole front.

The line of columns will have wide intervals with nothing in them; any rounds falling in the gaps will be more or less useless for observation purposes, and the difficulty of ranging will be further increased, if the infantry detachments advance by alternate rushes in chess-board formation, giving the artillery but a momentary glimpse of vanishing targets. The gunners will be still more puzzled by the difficulty of picking out the different groups, which will appear to them merged in one line if placed at the right distances behind each other.

On October 21st, 1899, at the action of Elandslaagte, four companies of the Devonshire Regiment, forming the reserve of the attacking force, "were formed in line

of company columns with 50-yard intervals. When the Boer artillery opened fire these intervals were widened and the Boer projectiles either went too high or burst in the spaces between the columns. FROCARD and PAINVIN, p. 134.

Then, again, infantry can take advantage of the veil of smoke produced by the enemy's shells to change its position if the *rafale* has fallen short, or if for some reason or other its destructive effect has not been sufficient to disorganise the men.

By carefully combining these different data, we get the following theory as to how infantry should proceed. The small columns lie down and get up at the sound of the whistle, and the officers, keeping an eye on the hostile artillery, make their men lie down the instant they see the flashes indicating the delivery of a *rafale*; the rush is made directly this has passed, having done but little damage and produced a protecting veil of smoke.

In a word, the system would consist of a series of rushes made by the infantry and *rafales* delivered by the artillery. This process might be possible if both parties were combining to carry it out, but we must not forget that the artillery will do all it can to put a stop to it.

Artillery officers, with any experience of the practice range, all know how difficult it is, even in the perfect security of a bombproof, to follow the progress of ranging and to appreciate the exact moment when the *rafale* is going to be delivered. Would it not, then, be rash to suppose that an infantry officer on the battle-field, even if he were well up in the enemy's system of fire tactics, could lead his men under fire and at the same time pick out the flashes that were meant for him from a long line of guns?

Doubtless it is easy enough to train men in a drill-field to rise, advance, and lie down at the sound of the whistle; but in broken ground, even with harmless bombs, made to simulate artillery fire, the system goes to pieces altogether.[1]

The only really practical help that infantry can get from observing the enemy's artillery fire, so as to regulate its advance accordingly, is to be obtained as follows:—

As soon as a body of infantry advancing under effective artillery fire sees that it has been bracketed, even within a long bracket of 300 to 400 yards, it lies down and waits. If the *rafale* arrives, the infantry takes advantage of the smoke to push forward. If the artillery ceases fire or continues ranging in an irregular fashion (for it cannot do so accurately on infantry when lying down and invisible), the infantry will do its best to advance by rushes. If the artillery goes in for short bracket *rafales*, the infantry may perhaps, by making a spurt, get clear of the dangerous zone.

Does this mean, then, that infantry confronted by quick-firing artillery must give up all idea of advancing in the open and make no use of its own fire?

Certainly not, as we have to reckon with the faults and mistakes certain to be made, with the *moral* of the troops, with unforeseen circumstances, and with the assistance given by the other arms.

A priori, it is true, the advantage lies with the artillery, but the skill and coolness of either adversary are the decisive elements of success.

And besides, this infantry, paralysed and powerless

[1] Experiments have been made in this direction by a group of artillery and a battalion of infantry forming a company at war strength.

though it be, still by its very passiveness fulfils an important mission. It neutralises in turn the artillery opposed to it, making it unavailable for use elsewhere, and allows other troops to manœuvre on more favourable ground.

INFANTRY UNDER COVER.—Infantry protected by natural or artificial cover, such as shelter trenches, walls, retrenchments, and the like, is still harder to reach than when lying down. The tactics of artillery will be much the same in both cases, its object being to keep the enemy crouching behind the obstacle, and to prevent him putting his head up to fire, thus protecting the advance of its own infantry.

At the action of Venter's Spruit (January 20th, 1900), in Natal, six English battalions were advancing across broken ground against the Boer positions, covered by five batteries in position on Three Tree Hill, 2700 yards from the enemy. Nine hundred yards from the Boer position the ground took the form of an open glacis. As soon as the British infantry reached it, the batteries on Three Tree Hill opened a rapid fire of four rounds per gun per minute for fifteen minutes. The Boer rifle fire immediately died down and the attack was able to make headway. The advance was afterwards counter-ordered, and the English infantry dispersed in different directions down the dongas, but the fact of the protection given by the rapid fire of artillery to infantry advancing against an enemy under cover remains clearly demonstrated.

In the special case of time shrapnel, fired at infantry behind a covering obstacle, it is essential to notice that, not the obstacle, but the man behind it is the objective.

The obstacle being stationary and plainly visible

allows of the bracket being shortened, so it might be tempting to use a shorter bracket of greater intensity or to keep the intensity the same and economise ammunition.

This system would be justifiable if the trench or wall were perpendicular to the line of fire, but this will rarely be the case. The quest of the short bracket will more often result in expending ammunition, tiring the detachments, and absorbing attention, to the possible neglect of more important tasks. It will be better, except under special circumstances, to keep the bracket long.

With the non-quick-firer, artillery had to be prepared to deliver its fire at the cover the moment the enemy showed himself. The *rafale* had to be directed short of the protecting mass when the enemy was trying to push forward, or beyond it, if he were retreating. In short, the zone of destruction had to be produced at the covering obstacle, or beyond, or in front of it, according to circumstances.

With the quick-firer the *rafale* is theoretically instantaneous and far-reaching enough to strike the enemy in either case before he gets far from his cover. Nevertheless it will be only prudent to prepare for cases where the first *rafale* has not done what was expected of it, and it may be necessary to repeat it once or more with greater or less elevation.

The same precaution is equally advisable when acting against infantry lying down in the open, which is trying to carry out some movement.

At the time of the English attack on the centre of the Boer position at the Battle of Colenso, on December 15th, 1899, the English saw "a mass of men clamber up the sides of Foot Wylie and disappear. Their artillery, that

is, the naval guns, thinking these were the assaulting party, ceased firing. As a matter of fact it was the Boers evacuating their trenches, which were placed at the foot of the position." If the English artillery had been in touch with the situation and had kept an eye on the Boers, it would have crushed them during this movement. This is what any quick-firing artillery that knew its business would have done.

FROCARD and PAINVIN, p. 226.

Time shrapnel is the true method of engaging infantry, however situated, whether in the open or under cover. Such is General Rohne's opinion when speaking of fire effect against objects hidden from view. "In reality decisive results can be expected only from shrapnel fire, in which it matters little whether the range be found exactly or is a little short." The German regulations express the same idea.

ROHNE, *Revue d'artillerie*, Dec. 1899.

Must we, then, conclude that percussion shell, either shrapnel or high explosive, are useless against *personnel*? By no means. "As regards common shell," adds General Rohne, "against targets that are covered from view, it will never have very much effect; one may be glad to have recourse to it, but its effect can never be counted on with certainty. This follows from the small surface presented by such targets, especially in height, and the difficulty of locating their exact position, if the earthworks have been traced with a moderate amount of skill."

It is, no doubt, impossible to reckon with certainty on the total material result of percussion fire, but it is only fair to add that such fire may produce considerable moral effect.

A few lucky percussion shells may produce the most appalling consequences within their limited radius of action, such as blowing a bloody hole in the firing line of a company hidden in a shelter trench, or crouching

behind a wall, where they thought themselves in safety, thereby demoralising the whole company. So quick-firing artillery will find it useful to combine a few percussion salvoes with the time-shell *rafales* against infantry that is out of reach of time-shell only. These percussion series may be likened to the final salvos in the breaching fire of former times, which of themselves did comparatively little damage, but still managed to bring down the masonry, as they came at the opportune moment, after previous firing had prepared the fall of the whole mass.

FIRE EFFECT OF INFANTRY AGAINST ARTILLERY.—At what range does rifle fire become a danger to artillery?

The Germans reckon that "well-sustained and well-directed rifle fire begins to take serious effect on artillery in position in the open at ranges between 1100 and 1600 yards. . . . Artillery cannot come into action at ranges less than 1100 yards under hostile infantry fire, unless the circumstances are exceptionally favourable, such as when there is effective cover. At the same time, when the infantry advances to the decisive attack, the artillery will do quite right to accompany it, even at this range, and in the open. . . . Below 1100 yards artillery which has no cover very soon loses its mobility, and at 300 to 450 yards can no longer limber up.

German Field Service Manual, § 623.

"Infantry fire that takes its adversary in flank must always be considered much more deadly."

The figures of the German drill-book are only comparatively correct; the shield, which is proof against rifle bullets, is an unknown quantity entirely to the advantage of artillery. Experience alone can decide these points.

As a matter of fact the Transvaal war seems up to a certain point to corroborate German opinion, if we bear

in mind that the Boers were famous rifle shots, while knowing how to make the most of their fire, and the English guns, on the other hand, had no shields. The indications thus furnished are all the more calculated to give artillery confidence. The teams, it is true, whether halted or moving slowly, are very vulnerable even up to a mile.[1] But artillery can manœuvre at far closer ranges, can come into action within 1100 yards of first-class unshaken infantry, and keep up its fire, though at the cost of serious loss. At Modder River the English batteries advanced to within 1800 yards of the Boer lines. At Graspan one English battery established itself within 1800 yards, and did not suffer much loss.

At Modder River a battery had twenty-five horses killed while limbering up just under 2000 yards from the Boers. At Magersfontein (December 11th) the English field batteries came into action 1200 yards from the kopjes held by the Boers, and the horse artillery at 1400 yards. FROCARD and PAINVIN, pp. 264, 341.

Below 1100 yards—even at 200 or 300 yards less range—artillery, though capable of continuing the struggle for a certain time, finds itself paralysed. This fact was strikingly demonstrated at the battle of Colenso (December 15th, 1899).

Two field batteries, the 14th and 66th, came and took up a position 750 yards from the Tugela, on the banks of which the Boers had their advanced trenches. Though received with a murderous fire, they held their own for three-quarters of an hour. The survivors then had to withdraw to a donga in rear of the battery. When

[1] At the battle of Modder River (November 28th, 1899) the Boers knocked over the battalion water-cart teams at over 1700 yards. (FROCARD and PAINVIN, p. 308.)

General Buller ordered a retirement three hours later it was only possible to get two guns away. The rest were abandoned.

Meanwhile the naval battery, though drawn by bullocks, had taken up a position about 400 yards in rear of the field batteries—that is, within 1100 yards of the Boer trenches. It was able to continue in action throughout the engagement, and to get away afterwards when the retirement was ordered, though "at the price of unheard-of efforts," the panic-stricken oxen having been killed or stampeded.[1]

FROCARD and PAINVIN, pp. 221, 223.

ACTION VERSUS ARTILLERY.

According to the drill-books in use by all the Powers the horses, as a rule, are sent away directly after coming into action, so there remains on the ground only the *matériel* and *personnel* required to fight the battery. It follows that, as far as concerns the vulnerability of *personnel*, artillery in action, especially if provided with shields, may be compared to infantry under cover. It is out of reach of the enemy's time-shell as long as it does not fire itself, so the tactics will be the same in both cases.

If the enemy's guns are in the open, in order to get at the detachments hidden behind their shields, artillery will act as against obstacles. The batteries told off for this duty must go in to within easy range (1600 to 2000 yards), covered by the fire of other batteries, which, with *rafales* of time-shrapnel, will keep down

[1] Losses of the 14th and 66th batteries R.A. :—

	Killed.	Wounded.	Prisoners.	Total.
Officers . . .	2	2	5	9
N.-Co.'s and Men .	8	18	64	90
Totals . . .	10	20	69	99

(FROCARD and PAINVIN, p. 238.)

the fire of the hostile artillery, or at least prevent it from doing much damage.

If the enemy's guns are masked by the ground the detachments, lying low behind their shields, thanks to this double protection, will be within reach neither of shrapnel nor common shell fired with flat trajectories. The case is similar to that of infantry sheltered by a wall that is itself defiladed. In such a situation, however, there is essentially a difference between artillery and infantry; the former is in its fighting attitude, the latter's position is purely passive, obliging it to wait, and is admissible only for second line troops. In both cases to reach such a target artillery must have guns with curved trajectories at its disposal. Such, indeed, is the solution adopted by the Powers, who have equipped their field artillery with howitzers and even mortars.

This question relates to guns of special calibres, and must form the subject of a separate work.

When artillery is limbered up, it affords, with its equipment, a most vulnerable target, not only from the number of its men and horses, but because it can make no reply. Coming into action is a very critical moment for this reason.

With non-quick-firers batteries were able to manœuvre and take up positions under hostile artillery fire. But most of the movements carried out by the German artillery during the war of 1870 within 2000 and 3000 yards of the French positions would be quite impossible to-day.

For this reason artillery officers should give their whole thought to avoiding hostile artillery fire before their own guns are in action. They must at the same time try to catch the enemy's batteries before they have taken up their positions.

When two opposing batteries mutually engage each other, one of the two, it is said, will silence the other in a few minutes.

But this does not necessarily mean that it will have destroyed its adversary's detachments. It will merely have obliged it to seek shelter from the menace of its *rafales*.

And besides, these detachments, if not demoralised, will still be able to play an active though curtailed part. They will take cover from the enemy's fire, but remain ready to make an immediate reply to him during the unavoidable lulls in his fire.

At the battle of Farquhar's Farm, near Ladysmith, on October 30th, 1899, says the correspondent of the *Daily Mail*, "when the British fire got too hot, the Boers ceased firing and took refuge in their shelters. Then when the fire of the English diminished in intensity they ran back to their guns, fired a few rounds, and again disappeared, and so on."

FROCARD and PAINVIN, p. 170.

It is hardly necessary to remark that the addition of shields to a gun adds a wonderful value to this interpretation of the action of artillery *versus* artillery.

As to the range at which this action will be effective, no precise figures can be given. The visibility and degree of defilade of the target, facilities for observation, etc., are essentially variable factors, to say nothing of the skill and coolness of the *personnel*. At the same time, it is reasonable to estimate that under normal circumstances artillery fire will produce decisive results on the hostile artillery between 2800 and 3300 yards.

By the German regulations, "artillery having already found the range can harass the enemy's occupation of his position at 3300 yards."

German F.S.M. § 630.

The intervals between guns lessens the battery's vulnerability; so that, when feasible, it is advantageous

to open out as much as possible. The German drill-book, which evidently thinks a good deal of this question of vulnerability, lays down that at the commencement of an action "intervals should never be less than ten paces if possible." F.A.D. § 298.

If the intervals are wider than the projectile's cone of dispersion, the hostile artillery will be greatly hindered; for, without wasting many rounds, the enemy will be unable to distribute his fire equally over the whole front. As in the analogous case of infantry formed in small columns, a special target, consisting of one or more subdivisions, will have to be allotted to each gun. Carrying out the same idea, it will be well to take wide intervals between batteries.

Thus it was that the three batteries of the 3rd Saxon Group of the XII. Corps artillery, when taking up a position north of Sainte-Marie, after this village had been taken by the Germans, took care to "keep wide intervals." G.O.A. p. 730.

If the artillery is numerically weaker than that opposed to it, its fire will not be made equally intense on every part of the objective. The object will be to reduce successive portions of the target, beginning with "those that are most dangerous or the easiest to crush." French F.A.D. § 486.

With non-quick-firers this piecemeal superiority could only be established after a more or less lengthy period of time; but with quick-firers it must be realised without delay, under pain of disaster. To attain it will call for the greatest tactical skill on the part of the *personnel*, coupled with an intelligent use of the ground and a ready grasp of all the chances that the fortune of war may offer.

ACTION VERSUS CAVALRY. According to the German regulations, "bodies in close order of the strength of a squadron cannot remain under artillery

fire in the open at ranges below 3300 yards, unless the latter has suffered serious loss or is hotly engaged with hostile artillery. . . .

" . . . Except on favourable ground, detachments of cavalry can face artillery fire under 1600 yards only when moving quickly, and under 700 yards only at the charge."

German F.S.M. § 630.

Cavalry being essentially a moving target, the mode of action that naturally suggests itself is that of "registered zone" fire—*i.e.*, in which the range and fuse for certain areas of ground has been determined beforehand. There can be no doubt as to this, except when cavalry suddenly appears on ground that has not or cannot be "registered." Everything will depend on circumstances. If the cavalry is advancing in a direction approximately the same as the line of fire, straight on to the battery across the open, and if the target is easy to point out, there will be some chance of the artillery successfully bracketing the target and delivering a *rafale* during its advance.

This method is fairly successful at experimental practice.

But if the direction of its advance is very oblique to the front of the battery, or if the ground be a little undulating or much covered with crops, it will be useless trying to hit a body of cavalry in such a manner.

It may be possible for the battery commander to see the target plainly when mounted, but the detachments on foot, and especially the layers, catch only fleeting glimpses, and before they tumble to it sufficiently to open fire, amidst excitement which soon becomes confusion, the horsemen would be into the battery. This is frequently seen at practice camps and manœuvres.

What, then, is artillery to do in such a case? It must bethink itself of Frederick the Great's advice, "to fire case and give them a last broadside at fifty or sixty paces." *Frederick the Great's Instructions to his Generals.*

Since the Seven Years' War the offensive power of cavalry against artillery has remained the same, but the latter has at its disposal far more perfect apparatus and machinery. Let us, then, exploit these improvements to produce, not a volley of case at point-blank range, as required by Frederick, but an absolute hurricane which will burst on the troopers as they get to within 400 or 500 yards of the guns. To this end, the few moments that elapse between the appearance of the cavalry and their actual arrival within easy range will be employed in laying the guns accurately and preparing the *rafale* as coolly as possible. This will consist of shell fused either at zero or a very short graduation, or else of percussion shell.

"When a battery is ridden into by cavalry," says the German drill-book, "there is no reason even then to lose hope." German F.A.D. § 189.

The teams and drivers, as long as they remained near the guns after coming into action, were very much exposed when attacked by cavalry. But to-day the *matériel*, which is all that is to be seen, offers very little opening for a cavalry charge, and especially if the gunners get behind the shields, the battery may be ridden through with impunity.

ACTION AGAINST LOCALITIES.

VILLAGES, FARMS, ETC.

The best way to drive the enemy out of a locality is to set it on fire. This fact is too well established to require the support of many examples from the war of 1870. However, we may recall one, which is characteristic.

Opposite the artillery of the IX. German Corps, which was so unfortunately engaged on August 18th, was the farm of Champenois. This obvious *point d'appui* for the French infantry was a standing menace to those Prussian batteries which had remained in position, but whose situation was most critical. General Puttkamer therefore concentrated on the farm the fire of the twenty-two guns still in action. The defenders, who really numbered very few, were driven out by its catching fire, and the Hessians entered without striking a blow.

G.O.A. pp. 695-6.

Rousset, p. 94.

Fire that is intended to set light to places will necessarily be carried out with percussion shell. But in important localities which may not catch fire quickly or throughout their whole extent, this alone will not be enough to turn out the defenders.

Besides, a proportion of the latter will be stationed on the borders of the locality, especially on the edge which forms the true firing line of the defence. So the action against a locality will in reality consist of two parts—

(1) Fire directed on the edge with time and percussion shell, and carried out in accordance with the general suggestions for action against infantry under cover.

(2) Fire distributed in depth on the interior and the flanks of the locality. This will be with time shrapnel, to get at the formed bodies of troops and harass communications; with percussion shell to set things on fire, demolish houses, and produce destruction and demoralisation.

The use of high explosives suggests itself for the latter purpose.

If the edge is formed by a continuous obstacle, such as a wall, breaches will have to be made in it, and so

batteries must be brought close up to within 1600 yards to carry out the demolition under favourable conditions.

Villages form favourable shelters in which to mass troops. Artillery must oppose the deployment of these troops, either in front, or better, on the flanks of the locality. For this purpose it must "register" the ground in front of the cover, so as to greet any enemy who shows himself with *rafales*.

This is one of the many duties incumbent on artillery, and one that it may perform with the greatest measure of success; for the enemy's infantry, even if victorious, will be unable to deploy under artillery fire, and debouch from a locality that it may just have captured.

At Sedan two solitary French batteries, overwhelmed by the Prussian artillery of the V. and XI. Corps, nevertheless managed to remain in action, "and for some time prevented the German infantry debouching from Illy." G.O.A. p. 1167.

WOODS. When there are glades or clearings in a wood, the artillery must try to command the exposed ground. It will thus considerably interfere with the movements of any of the enemy who have got into the wood, and may even prevent his further advance.

"The advance guard of the 18th Prussian Division, on August 18th, after occupying the farm of Chantrenne, had met with stubborn resistance in trying to advance further through the wood to the south of the farm. The difficulties experienced by the Germans arose partly from the fact that a French battery commanded a clearing which separated the wood from that of Genivaux." G.O.A. p. 681.

Distribution in depth when firing at a wood is open to serious objection, from the extreme expenditure of

ammunition that may take place without result when quick-firing guns are used.

Woods naturally present a considerable extent of surface. It would certainly be the wildest waste of ammunition to send *rafales* at random into these unknown spaces with the idea of discovering what was in them. Nevertheless, if it is definitely known that the enemy is occupying a wood in force, it is possible to engage it effectively, as long as the means are made proportionate to the end—that is, the expenditure of ammunition to the possible or probable fire effect.

By the evening of August 18th the IX. German Corps found itself exhausted and brought to a standstill before the French positions of Amanvillers. "Part of the 3rd French Corps, supported by two machine guns," relates Colonel Rousset, "occupied the cluster of woods situated between Chantrenne and La Folie, and was victoriously resisting all the enemy's attempts to capture their stronghold."

ROUSSET, Vol. II. p. 135.

So the Germans had recourse to the artillery of the III. Corps (one brigade division of corps field artillery and the heavy batteries of the two divisional artilleries). These eight batteries, joined to the two others belonging to other corps and already in position, formed two bodies of five batteries each. "As night fell they opened a very heavy fire on the troops holding the little wood, in whose ranks the shells blew great holes."

G.O.A. p. 820.

It seemed probable that this fire, according to the opinion of the experts on the spot, would cause more noise than casualties, and was only justified by considerations of the moral effect. However, this was not the case, and it is interesting to hear General Dresky's astonishment on the subject, who was the Colonel commanding the Corps Artillery of the III. Corps.

"The officer in command at the farm of Chantrenne," he relates, "asked me to bombard a wood opposite the farm, strongly held by the French, so that our own people might attack and capture it. It was but half-heartedly that I acceded to this request, as I had comparatively little ammunition, and did not really think that anything much was to be gained by the action. Though I bombarded the wood several times over, our men, in spite of repeated attempts, could not succeed in taking it.

"The contest had cost me 200 rounds. Two days afterwards I was visiting the battlefield with General von Bülow, paying particular attention to the positions with which I had had to do. What was my astonishment to observe that the effect produced on the forest by our batteries on the 18th was very considerable and really extraordinary. One could not help feeling, in spite of oneself, a profound respect for the plucky defenders, who, notwithstanding the severest punishment, had held their ground."

At Sedan, about two o'clock in the afternoon, when the French troops had been driven back to the north and east into the wood of Garenne, ten batteries of the Prussian Guard made this wood their target, "which they riddled with projectiles." A hail of shells ploughed through the masses of infantry crowded up in great disorder, through which the squadrons were still madly riding. The artillery began by shelling the clearings in which the hostile troops appeared. But the fire soon became methodical. "For this purpose," relates Prince Kraft, "I divided up the long line of forest before me into slices, giving one slice to each of my batteries. The first gun of every unit was told to aim at the very edge of the wood, and each gun in

G.O.A. pp. 1167-9.

G.O.A. p. 1194.

succession fired in the same direction, but increased the elevation by 100 paces at every round. In this way the edge of the forest and the forest itself for a depth of 500 paces was covered with a hail of shells. The splinters went still further."

So it was true distribution in depth, with echelonned elevations, that the artillery of the Guard employed on the wood of Garenne.

Artillery in action against a wood can bring very effective fire to bear on it if sufficiently well informed as to the movements of hostile troops inside.

On August 30th the IV. German Corps was marching on Beaumont in two columns through the woods of Dieulet. To the right of the IV. Corps marched the XII., also in two columns, and on the left was the I. Bavarian Corps, in a single column. These five columns were from 1600 to 2200 yards apart, and communication between them was very precarious.

The 5th French Corps was completely surprised in its camps round Beaumont 1200 yards from the woods, and yet the troops managed to pull themselves together fairly quickly. A few guns came into action actually in their camp south of Beaumont, and two or three batteries took up a position on the heights north-west of Beaumont and opened a heavy fire on the edge of the woodlands. "The shells even reached the German troops that were still on the march through the woods." G.O.A. p. 994.

Our remarks as to artillery fire preventing the issue of an enemy from a village and its approaches apply even more forcibly to the exit from a wood. The edge of a wood, as a rule, offers very few points of exit, and communication between the troops is most difficult to maintain.

Thus, during the afternoon of August 18th, some batteries of the 2nd French Corps (Bastoul's division) greatly assisted in preventing the issue of five battalions of the VII. German Corps from the northern edge of the wood of Vaux, on the left of the French positions.

So we may well think that at Beaumont, artillery armed with quick-firers and not so heavily handicapped as was that of the 5th French Corps, would have resisted all attempts of the German columns to debouch from the woods, when we remember that along a front of more than three miles the Germans had but four exits available for use.

ACTION AGAINST ENTRENCHMENTS. The tactics advisable against entrenchments are the same as those employed against infantry under cover and against localities.

Fire will be directed at the same time on the enemy's firing line, that is, the trenches, and on the interior of the works. "It must be borne in mind that it is only wasting ammunition to fire at unoccupied or weakly-held trenches." German F.A.D. § 354.

At the same time, even more than in the former cases, endeavours will be made to screen batteries, and earthworks will be thrown up for one's own troops.

Lastly, the use of heavy type field guns is clearly advisable for attacking entrenchments. But the question of these special weapons, as we have already observed, has been treated separately in another work.

As we have remarked, with regard to fire effect, little result must be expected from field artillery fire against entrenchments.

On December 10th, 1899, at Magersfontein, four field batteries and one howitzer battery bombarded the koppies held by the Boers for two hours, at ranges of

2700 yards. "As a pyrotechnic display," says the *Morning Post* correspondent, "the bombardment was perfect, especially when at nightfall the salvos of the howitzers produced a series of volcanic explosions worthy of Etna and Stromboli. But from the tactical point of view it lacked interest, as the enemy made no reply."

FROCARD and PAINVIN, p. 326.

At nightfall the English had simply wasted their ammunition to no purpose.

ACTION WHEN IN OBSERVATION. We will for the moment merely notice the method of performing this duty, neglecting the tactical conditions under which certain batteries may have to remain in observation during the different phases of the combat.

The choice of fire tactics will depend on the targets, and therefore comes under the same heading as the cases already studied. But the characteristic feature of this method of action is its preparation.

Among the most important of the various operations composing its preparation is the apportioning of the target, which is here based on the extent of front to be watched. The ground will be divided in sections among the different units told off to "observe" and subdivided by the units among their guns.

But it is not enough merely to divide up the ground mechanically and distribute the portions of front to be engaged equally all round. It is essential, in apportioning it, to consider the ground both from the topographical and the tactical point of view.

In a section that is flat and open and not specially threatened, a single battery can watch a wide front, but this would be much reduced if the ground were broken and enclosed, or of great tactical importance. In this case fire might have to be distributed over a great depth,

either from the succession of targets that might appear or owing to the difficulty of ranging.

The final preparations have as their object the "registration" of ground and the determination of range and fuse for any targets that may eventually present themselves.

PART III

ARTILLERY ON THE MARCH AND WHEN HALTED.

CHAPTER I.

ARTILLERY ON THE MARCH.

"An advance guard generally comprises detachments of all arms. . . . Artillery in varying strength according to circumstances and the nature of the country. . . .

"Artillery should, as a rule, be near the heads of columns with a view to coming speedily into action. . . . At the same time, its security forbids it ever to be actually at the head of the column, while care must be taken also not to delay the arrival of the infantry unduly.

"In the usual case of an army corps marching as one column, the divisional batteries of the leading division not told off to the advance guard will generally be placed behind the leading battalion of the main body, the corps artillery behind the leading division, and the batteries of succeeding divisions between the two brigades of their division.

"If it has been found necessary to put all the artillery of the leading division in the advanced guard, it may be expedient to bring the corps artillery to the head of the column."

(*Regulations for Field Service*, §§ 23 and 47.)

POSITION OF ARTILLERY IN COLUMNS OF ROUTE.

When Advancing.—A correct idea of the proper distribution of artillery in a column has existed ever since the first appearance of guns in the field. "Even in Louis XII.'s time guns of small calibre were placed in the advanced guard, and the heavy pieces marched with the battle corps, protected by the Swiss."

Favé, Vol. I. p. 133.

Without making it a hard-and-fast rule, Guibert saw

that it might be expedient to place some artillery at the head of the column "to protect the deployment"; in which case he advised "that it should get rid of all its baggage and train, as well as its reserve ammunition, which would march at the tail of the column." LISKENNE, p. 444.

In the days of short-range smooth-bores artillery was protected by infantry a few paces in advance.

Apart from the question of security, however, the disadvantages of artillery being thus pushed out in front, which we will discuss later, in connection with the preliminaries of the combat, were not long in making themselves felt. Du Puget also reminds us that "it is dangerous to show your batteries long before making use of them." Gassendi, speaking of the same thing, recommends "that batteries should not be placed in position too early or too much in the open." DU PUGET, p. 43. GASSENDI, p. 1148.

On the whole, then, we see that in the smooth-bore days there was no fixed rule as to the place of artillery in a column. It depended on the deployment to be carried out, or, to use the term in vogue at the period, on the order of battle which the General commanding had adopted in organising his army.

In 1866 the Prussians, following their traditions, put their artillery reserves at the tail of their columns, in consequence of which they nearly always arrived too late on the scene of action. So they took care after the war to abolish these reserves, and pushed their artillery up to the heads of their columns.

A study of their army corps and divisional orders of march in 1870 shows a distinct tendency to scatter the divisional artillery throughout the whole column, at the risk of breaking up brigade divisions and even batteries. Artillery is even pushed up next to the vanguard battalion, and the bulk of it—that is, the corps *Order of March of the 1st Bavarian Corps, Aug. 3rd, 1870.* One section was allotted to the van-guard.

artillery—to the centre of the column's main body, or even still further to the front.

In France, where there were no official regulations bearing on the constitution of large units or the formation of columns, we set resolutely to work after the war. It is mainly to General Lewal that we owe this movement, of which he was the leading spirit.

Our earlier efforts, modelled, as a matter of course, on the system of our conquerors, led to the adoption of normal orders of march, which reproduced in a general way the corresponding formations of the Germans.

But, from the natural tendency to the opposite extreme, this wholesome reaction could not fail to produce two results, both founded on dangerous and misleading theories—namely, sealed pattern orders of march and the pushing of artillery to the heads of the advanced guards.

The Germans, on the other hand, came to the opposite conclusion after their experience in 1870. Notwithstanding the successful issue of their operations, they had doubtless taken into account the points open to criticism, such as the breaking-up of tactical units, the insecurity of batteries pushed out in front, the risk of precipitating an engagement independently, or even in opposition to the wishes of the column commander, and the arrival of artillery units one after another.

These ideas were crystallised in the German regulations; and the latest form in which they are officially expressed is the *Manual of January 1st, 1900, for Service in the Field.*

"It lies with the commander of the advanced guard to decide *as to what opportunity there may be* of allotting field artillery to the advanced guard, and, in case of need, as to the requisite proportion. . . . Complete

tactical units will, as far as possible, be told off to the advanced guard. . . .

"Field artillery is pushed as near the head of the column as is consistent with its safety, having in view the advisability of its coming into action as early as possible; if it forms too lengthy a column, it may be wise to sandwich in a detachment of infantry." German F.S. § 147, 340.

This is all the German regulations have to say about the distribution of artillery in a column; but these few lines, terse as they are, contain all that need be said on the subject.

Yet their natural tendency is to go further. Greatly possessed with the idea of bringing the mass of their artillery into action from the very first, at all costs, the Germans increase the number of their columns, as we shall presently see, so as to give each division a separate road: "Divisions are generally preceded merely by weak advanced guards of cavalry and infantry, whose sole duty is to provide for the immediate security of the column." In each division the artillery is pushed as far to the front as circumstances may require. *Imperial German Manœuvres*, 1899. (*Revue militaire de l'étranger*, March, 1900.)

The adoption of such a system pre-supposes the existence of a highly organised cavalry screen.

The French regulations have not been drawn up in as liberal a spirit as the Germans. True, they have done away with normal orders of march, and have gone back to the old system of the smooth-bore days, which has the advantage of being adaptable to any circumstances likely to be met with on service. But they do not legislate definitely for cases in which it would be inadvisable to have any artillery in the advanced guard, and even give as a sort of guide a typical order of march for use "under ordinary circumstances."

We see how widely opinions have differed in the last

thirty years. To appreciate these contentions at their proper value we must examine the two main reasons that determine the position of artillery in columns—namely, its security and the part it has to play in the fight.

At first sight these obligations appear contradictory. To satisfy the first, artillery must be sufficiently far from the head of the column to run no risk of being exposed to the enemy's fire while in column of route; to fulfil the second, it must be close enough to the head of the column to lend a hand at a moment's notice if required.

With the quick-firer now in use, any artillery caught in columns of route or in the act of manœuvring within 3800 yards, or even longer range of hostile batteries in position, is as good as lost, or at any rate dangerously compromised. It is therefore necessary while on the march to have artillery covered by infantry; I say covered by the rifles of infantry, and not merely escorted by cavalry scouts.

The infantry will make it their business to provide the batteries with the necessary *manœuvring zone*, which they must possess if they are to occupy their first positions without exposing themselves to view. This will also obviate the possibility of their having to move to a flank or retire to a position that has already been passed on the march.

This system is nothing but the application to a particular instance of the general principle laid down by our drill-book: "It is under cover of the artillery that the other arms advance, and they in return guarantee its security."

French F.S. § 135.

In examining the question from the point of view of the part to be played by the artillery, we must distinguish between the special and ulterior *rôle* of the

advanced guard artillery and that of the bulk of the artillery in the column. It is for lack of such adequate distinction that, to my mind, the question of artillery distribution remains ill-defined.

For the moment we will admit that, in large columns, except under special circumstances, a certain proportion of artillery must be given to the advanced guard, in spite of the tendency of the Germans, whose remedy is perhaps worse than the evil. The bulk of the artillery—in other words, its centre of gravity—will be pushed as close as possible to the head of the main body.

This will be the case as a rule. But in special cases artillery will be relegated to the tail of the column. For instance, in night marches, or in country where artillery would have no chance to deploy (the German columns in the forest of Dieulet on August 30th), and in operations that must be begun exclusively by infantry (passage of the Meuse and surprise of Bazeilles, on September 1st, at dawn and in the fog, by the 1st Bavarian Corps), etc. . . .

On the other hand, in a strategical pursuit the bulk of the artillery can be pushed well to the front, if it is required, to prepare the passage of a river, or intercept the enemy's line of march, etc. Thus on August 31st, 1870, six Bavarian batteries of the II. Bavarian Corps (in second line) went ahead to give assistance to the I. Bavarian Corps in facilitating the passage of the Meuse at Aillicourt.

All this applies only to large bodies. In small columns, up to and including an infantry brigade, the question of security as a rule forbids the employment of batteries in the advanced guard, and necessitates artillery being relegated to the head of the main body,

or further back still, according to circumstances. The integrity of the brigade division will follow, as a matter of course.

There is no tactical disadvantage in keeping batteries 1000 or 1500 yards in rear, as it represents a trot of only five or six minutes. These few minutes will give the necessary time for the artillery leaders to reconnoitre their position and make arrangements for its occupation.

In both large and small columns advantage will be taken of the distance between the advanced guard and the head of the main body to place artillery there, which will thus be enabled in case of need to start trotting without bothering the infantry, and join the advanced guard. In such a case it may be useful to bear in mind the advice of the German regulations and sandwich in some portions of infantry along the column of guns. In large bodies it is possible, instead of placing the artillery normally assigned to large units in their midst, to send them up to the heads of these units. So must we understand the expression "pushing artillery to the head of *the column*," and not as meaning that we should adventure batteries at the head of the advanced guard. In this manner we may realise the desideratum formulated by Prince Kraft with regard to the deployment of artillery "Save hours, and not minutes."

Letters on Artillery, 6th Letter.

IN RETREAT.—In falling back, as in advancing, the distribution of batteries in the order of march depends both on the security of the guns and the duty they have to perform. At the same time a rearguard must be stronger than the advance guard in a forward movement, especially in artillery, because it cannot count on the main body for support.

French F.S. § 25.

As far as concerns security, the rear guard artillery must be assured a manœuvring zone by the infantry of the rear guard, unless required to sacrifice itself for the common good. As regards the guns of the main body, which in an advance are pushed up towards the advanced guard, there is everything to gain in separating them from the rear guard when retiring.

As a matter of fact, either the commander of the column determines not to accept an engagement, slipping away with the loss of his rear guard, in which case there is nothing for the bulk of the artillery to do, and it is of the utmost importance to get it out of the way and clear the roads; or the commander means to halt in a fighting position. In this case it behoves him to get the principal portion of his artillery there in time to rally the column and give it a chance to assume its fighting formation.

So it is inaccurate to say that in a retreat columns merely reverse the formation in which they advance.

It would be out of place here to go into the discipline and executive details peculiar to it of artillery on the march. But there is one point of the first importance which deserves attention in view of the great concentrations of guns, and that is the question of long, rapid marches. "Formerly," says Prince Kraft, "the thing was to save a few seconds so as to get off the first rounds smartly; now it is not a case of that—it is a question of saving hours. . . . The Prussian artillery was well aware of this after 1866, and preferred horses that could stay, with which they could execute forced marches, rather than animals that could manœuvre prettily.

6th Letter on Artillery.

"So in time of peace the artillery was systematically drilled to concentrate quickly in large masses, after covering great distances."

On the morning of September 1st the Prussian Guard was advancing in two columns to the line of the Rulle.

The right column, consisting of the 2nd division, followed the route : Escombres, Pouru-aux-Bois, Villers-Cernay.

The left was formed by the 2nd infantry division, the corps artillery, and the cavalry division ; they took the road Sachy, Pouru-Saint-Remy, Francheval. The 2nd infantry division had been assembled at Sachy. The corps field artillery and a cavalry brigade with a battery of horse artillery had been billeted in Carignan, and the other two brigades with two horse batteries had assembled at Osnes.

"The Guard Corps artillery made the following marches during the progress of its different movements.

The 2nd division first despatched two squadrons and two batteries at a trot from Sachy to Francheval (five miles). The corps field artillery began trotting on leaving Carignan, joined the column of the 2nd division at Pouru-Saint-Remy (five miles), and took its place in the advanced guard.

"The Guard Corps cavalry brigade, coming from Carignan at the same pace, with the 1st horse battery, reached Francheval at the same time as the main body of the 2nd division.

"The other two cavalry brigades, as well as the horse artillery batteries, trotted without stopping from Osnes to Francheval (six and three-quarter miles), where they formed up at the tail of the left-hand column.

"Having arrived at Francheval the corps field artillery received orders to proceed *viâ* Villers-Cernay ; so, forcing the pace, it made for the latter village, which it had

cleared before the arrival of the 1st division's main body, and came into action only a few moments after the artillery of the 1st division." G.O.A. p. 1130.

Thanks to the rapid converging movement of all his batteries, Prince Kraft was able to reply, "not without some pride," to General von Pape who, after passing the Villers-Cernay wood with the head of his advanced guard, begged for a couple of guns to enfilade the French artillery on the right bank of the Givonne, "You shall have not two but ninety." PRINCE KRAFT, 2nd Letter.

To appreciate the points of such a march and turn to account the valuable instruction it affords, we need only read the following lines, written by Prince Kraft himself. "In order to arrive in time to take part in the battle of Sedan," he relates, "the Guard Corps artillery did the nine and a half miles between Carignan and Villers-Cernay in one long trot. At the end of this I gave orders to dismount, while I went on to reconnoitre, and gave the horses time to get their wind, for they were done to a turn. After five or ten minutes' rest the batteries left the bottom of the ravine and began to climb the heights on the other side, but there was no showy galloping and it was extremely hard work. Gunners, men of the Guard Fusilier Regiment, and dismounted Hussars, all had to lend a hand in dragging the guns and manning the wheels. Our long trot had enabled the bulk of our artillery to arrive on the ground several hours in advance, so they could spare the few minutes necessary to choose the best positions and occupy them at leisure."[1] 2nd Letter.

[1] Compare the march of the 62nd Battery, R.F.A., from Belmont to Modder River on December 28th, 1899, a distance of thirty-two miles, a great part of which was through deep sand. (TRANS.)

Such marches as these can only be carried out by artillery under cover of the advanced guard. They may be called for not only to effect large concentrations of guns before an engagement or in its early phases, but also during the progress of the fight, as we shall find later on. In any case, it will often be wise for batteries, even if belonging to second line corps, to have a cavalry escort, for, as the German drill-book says, "artillery on the march must be considered defenceless against cavalry attacks unless protected by other troops."

German F.A.D. § 625.

If it seems likely that artillery, which has been thus pushed forward, may have to manœuvre and take up a position on ground not entirely secured by infantry, a few of the latter may be sent up on the carriages in place of gunners (seventy-two in the second line ammunition wagons of a brigade division). But in that case every care must be taken that the spare numbers left behind do not fail to rejoin the wagons as quickly as possible.

When artillery marches by itself it can keep up without undue fatigue a speed of five or five and a half miles an hour for three or four hours on good roads, alternately trotting for fifteen minutes and walking for ten. The rates generally given for field artillery are less than those attained on roads at peace manœuvres, with good march discipline and a little enterprise.

In answer to the objection that in time of war the rates of marching will be lessened by the presence of requisitioned horses, it may be maintained that the figures given by the regulations apply to the peace establishment in horses, and not to the numbers that would be available after requisitioning.

When the column can open out without prejudice to the other arms or its own safety, it is a good plan to

allow batteries to regulate their pace independently, so as to trot whenever the road is flat or gently sloping. When all is said and done, as the German regulations say, "pace depends on the commander's intentions, the tactical situation, and the state of the ground. *The horses have not done their work till they have got the guns into action, even at the cost of utter exhaustion.*" German F.S. § 303.

When batteries have to push rapidly to the front they will often have to pass other arms, especially infantry, and troops should be practised in this manœuvre, whether the infantry halts or continues marching. This halt may be one of the periodical ones or supplementary to the others. But in the latter case there need be no great opening out, as the troops next in rear of the guns can continue their march while the latter are getting past in front, and the space left vacant by the batteries will be filled by the troops in rear closing upon those that are halted.

The German regulations lay down in great detail, contrary to their usual custom, the steps to be taken "when it is of special importance to keep one side of the road clear." They have even assigned a special bugle-call, "Bear to the left (or right)," for the purpose, thus showing how much importance they attach to the rapid and correct performance of this movement. The passing of artillery from the rear of a column to the front is evidently one of the cases which this regulation is framed to meet. German F.S. § 316, 319.

MARCHING WITHIN STRIKING DISTANCE OF THE ENEMY.—When nearing the enemy the artillery of any corps in first line must adopt formations which allow of the ground being utilised to conceal its advance. When it is possible to move across country, the most suitable

formation will usually be line of battery columns,[1] with one or two carriages abreast, according to circumstances, and varying intervals. At the same time, if a ridge or plateau has to be negotiated in full view of the enemy, it may be advantageous to form line in rear, and traverse the dangerous zone at full speed. If the going is bad the detachments dismount and precede or follow the guns at the double. When the batteries are again under cover they break into a walk and re-form column.

It has been suggested that advance guard batteries should push on by rushes from one ridge to the next, in front of the infantry they are covering, rapidly changing their position as soon as the latter come up alongside. This mode of action takes for granted that the ground favours the movement of guns at high speed, and its adoption would run the risk of soon breaking down the teams. Besides, if they acted in this manner, batteries could not reap the benefit of the security that infantry should ensure them. So they must content themselves with making their way according to the principles already laid down, either by one continuous advance or by rushes, either along the roads or across country, but invariably restricting themselves to the zone of protection afforded by the rifles of the advanced guard.

Protected by the leading detachments of the advanced guard infantry, which occupies tactical points as it moves forward, the advanced guard artillery takes up or prepares for the immediate occupation of successive positions, either in support of these advanced detach-

[1] The French "battery column" is really "column of subdivisions," with each wagon following its own gun, or immediately on its left ("*colonne par pièce doublée*). (TRANS.)

ments, or to cover the march of the more compactly-formed bodies of infantry in rear.

The necessity for this mutual protection by the two arms must be most carefully provided for when portions of open ground have to be crossed that may be swept by the enemy's fire.

This is the main object that artillery must have in view, while the methods of execution are essentially variable and depend on circumstances.

If the artillery commander thinks that the General may soon call for his batteries he may send them forward, provided their safety is not compromised, so that if the orders do come they may be carried out all the quicker.

On August 18th the corps artillery of the Prussian Guard was marching behind the leading division. Its leader, Colonel de Scherbening, on first hearing the sound of guns, disengaged his batteries "to the flank of the column, and started trotting, the batteries advancing in line one behind the other." This movement enabled him to arrive on the scene of action almost at the very moment when Prince Kraft, commanding the Guard artillery, was in the act of sending for him. PRINCE KRAFT, 16th and 5th Letters.

Large bodies in second line, when nearing the enemy, like the German Army Corps on August 18th, march off in the formations in which they assembled. There is nothing particular to say about the artillery, except that the roads are reserved for it as soon as possible.

CHAPTER II.

ARTILLERY IN CANTONMENTS AND IN CAMP.

THE system of quartering artillery in billets or otherwise is in no way modified by the increased power of its weapons, either as regards private arrangements or its mutual relations with other arms.

It is beyond the scope of this work to consider the former, whilst it will suffice for the latter to recall the following dispositions, which are increasingly important in proportion to the size of the unit in question:

German F S § 355.

"Endeavour must be made," say the German regulations, "to make use of all the stabling, the different arms being mixed up in their cantonments."

The result of fully exploiting the resources of cantonments is to break up artillery units and disperse the troops contrary to all tactical considerations. So, "when nearing the enemy," it is carefully specified in the same regulations that "artillery shall on no account ever be left unsupported, either in bivouac or in cantonments."

German F.S. § 357, 388.

French F.A.D. § 486.

French F.S. § 28.

German F.S. § 195.

In whatever way they are quartered, "outpost duty is done entirely by the cavalry and infantry. The employment of guns on outpost is exceptional, and only happens when important points have to be guarded, especially defiles . . . in which case they generally rejoin the main body at night."

Under these exceptional circumstances it may sometimes be possible to utilise the powers of the quick-firer and employ but very few guns, one section, for instance, to attain the desired end.

The breaking-up of artillery units, which as a rule must be absolutely forbidden, is justified in this instance, for the object is to have as few guns on outpost as possible.

There is, however, one case when artillery may have to bivouac close to the enemy, and that is when it spends the night on the battlefield, so as to be able to resume the combat at daylight next morning. This is really not a question of quarters, but an episode of the fight.

Such incidents will be of more frequent occurrence than hitherto in the great battles of the future, which may last for days. The increased range will make it easier for batteries to remain in position out of sight of the enemy.

At half-past eight in the evening of August 18th Prince Frederick Charles gave orders to his army corps to "bivouac on the ground which they held at the close of the engagement, and to be on their guard against the desperate attempts which the enemy might make to cut their way through in the night." In accordance with these instructions the 1st divisional artillery of the Guard remained facing the enemy on the heights south of St. Privat. G.O.A. pp. 866-7.

At nightfall on August 31st, after the abortive attack of the 1st Bavarian Corps on Bazeilles, General von der Tann bivouacked his troops on the left bank of the Meuse, opposite the crossings, ready for the operations of the morrow. "Eighty-four six-pounders were in action on the heights of Aillicourt." *Ibid.* p. 1073.

On the morning of December 12th, 1899, after their repulse at Magersfontein, the British commenced their retirement. "The Boers then opened fire, and the British artillery, which had spent the night on the battlefield, immediately replied."

FROCARD and PAINVIN, p. 349.

PART IV.

ARTILLERY IN THE FIGHT.

CHAPTER I.

FUNDAMENTAL PRINCIPLES OF THE EMPLOYMENT OF ARTILLERY IN THE FIGHT.

THE expression "employment of artillery in the fight," which has for some time been officially recognised in our regulations, gives an admirable definition of the subject with which we have to deal. The usual phrase "tactics of artillery" would lead one to suppose it a distinctive feature of the corps, but this heresy should be avoided even in name. The art of tactics, as every one should know, is universal, applying equally to all, and not to each arm individually.

EMPLOYMENT OF ARTILLERY IN MASS AND SPLITTING-UP OF UNITS.

ORIGIN OF MASSING ARTILLERY.—"Cannon, treated individually and aimed at a solitary object of inconsiderable extent, are not very formidable machines." LISKENNE and SAURAN, Vol. V. p. 438.

This axiom was formulated by Guibert at the end of the eighteenth century, and up till then had been hardly recognised by any one, with the exception of a few military leaders.

"I pray you," said Bayard to the Grand Master of

Artillery at Marignan, "I pray you fire seven or eight guns altogether"; and the chronicle relates that "they made such gaps in the enemy's ranks that one saw Swiss blown into the air like powder."

FAVÉ, Vol. I. p. 179.

At Leipzig, Gustavus Adolphus once assembled all his regimental guns into one great battery, to resist an attack by the Imperialists, and at the passage of the Lech he formed seventy-two guns in four batteries.

Ibid. p. 327.

Ibid. p. 331.

In the following century, Frederick II., instead of following the old system and dispersing artillery by small detachments in the intervals or in front of his infantry, was guided by the example of Gustavus Adolphus. He united it in brigades, or groups of ten to thirty guns, which he disposed between the divisions of his army on the flanks and centre.[1] At Buchensdorf he even formed one battery of forty-five howitzers.

GREWENITZ, p. 52.

If the Seven Years' War did not actually fix the essential principles of the employment of artillery, it was at least replete with instruction.

"For artillery to obtain decisive results," said du Puget in 1771, "batteries must be strong, and afford each other mutual protection."

DU PUGET, p. 42.

Two years later, Guibert wrote: "Any one who knows how to use his artillery forms big batteries."[2]

LISKENNE and SAUVAN, Vol. V. p. 433.

These ideas recur in the regulations of April 1st, 1792, for artillery duties in the field; the "reserves" being evidently reminiscent of the "Prussian brigades."

Ibid. p. 448.

While recognising that "fire must be concentrated if

[1] At Leuthen, for instance, the artillery was divided into three strong brigades of twenty, thirty, and thirty-one guns respectively. (DECKER's *Seven Years' War.*)

[2] We must add that the first part of *The Essay on Tactics in General*, by Guibert, was published anonymously in London. In 1773 no publisher in France would have dared to bring out a work so subversive of the official doctrines of the day.

it is to inflict decisive loss," endeavours were still made to "parcel out" batteries for their better protection. Nevertheless, once the existence of a common objective was admitted, the idea of strong batteries, which at first had been reluctantly entertained, followed as a matter of course. So from the earliest engagements of the Revolution the employment of artillery in massed batteries shows a tendency to systematic evolution, notwithstanding the imperfections and fallacious theories attributable to untried troops.[1]

At Valmy the Prussian leader Tempelhof directed the fire of fifty-four guns; on the French side Sénarmont and d'Aboville formed a battery of twenty-four guns near the windmill. At Castiglione, the artillery of the French army formed two batteries. CHUQUET, Vol. IV. p. 219.

"I have never seen anything so imposing," relates General Lespinasse, "as the van of the army of Italy driving the Austrians in front of it on the 18th Fructidor, Year V. It had no guns in its front, as I always advocate, but twelve pieces of foot artillery were on its left, on the heights before Castiglione, and twenty light pieces on its right, which stretched down into the plain. Supported by these two flanking batteries, the army advanced in silence, without breaking its line, and without firing a musket, but putting everything before it to flight." LESPINASSE.

This is a clear instance of massing artillery, and we

[1] Some days before a battery had been established on the extreme right of the advance guard, near Little Steinfeld, so to speak in the sentry line. At first it was to contain only two 4-pounders, but was enlarged to hold 8-pounders. It was enlarged still more to take 12- and 16-pounders. Not content with this, and as it was found that guns of the latter calibre could not range far enough, some 24-pounders were finally installed in the advance guard, right in the very furthest outpost line." (SAINT CYR: *Armies of the Rhine*, p. 112.)

need hardly recall the masterly manner in which Napoleon turned it to account. But still, from the feeble range of the smooth-bore, a widely-extended front was prejudicial to concentration of fire.

THE "BATTALION GUN."—Side by side with the evolution of artillery concentration there still existed, curious to relate, an absolutely opposite method of employment—namely, the dispersal of guns, which alternately waxed and waned in favour.

Gustavus Adolphus, in order to utilise the mobility of his field guns, had bestowed them on his infantry regiments.

This device was, strictly speaking, admissible as long as the equipment was not light enough to be freely used in the field. But at the same time it ran counter to the principle of fire concentration, and had the further serious disadvantage of scattering the guns to the detriment of their proper care and preservation. Besides, in thus burdening the infantry there was a risk of inducing habits of timidity and hesitation in leaders of regiments and battalions, who were weighted with responsibilities from which they should have been kept free.

However, the brilliant campaigns of Gustavus Adolphus had the fatal consequence of making all European armies adopt the regimental gun system, and of preserving it "far too long, considering how little use it was."

DECKER, p. 242.

Notwithstanding its condemnation by the most competent men and its innate futility, this system was alternately taken up and dropped again according to the opinions of the day, but invariably lacked success. Misunderstood and servilely imitated, this fashion exercised a baleful influence on the progress of artillery throughout the eighteenth century.

Apart from their regimental artillery, armies continued, of course, to take with them their parks, of which the weapons were manned by the corps of artillery, and formed what was also called position artillery.

The regimental guns in some armies were manned by artillerymen, and in others by men borrowed from the regiments and battalions to which they were attached. The Prussians combined both schemes by drawing their gunners from the infantry and N.C.O.'s from the field artillery. Both systems were equally open to objection, as one absorbed a considerable part of the artillery *personnel* to no purpose, and the other gave no opportunity for the effective employment of its important *matériel.*

Regimental artillery, however organised, was based on a faulty system, and after experience had condemned it, the French armies abandoned its use during the confused period of the earlier Revolutionary wars. Though the "regimental gun" was officially retained in current regulations, officers and men combined to reject it. LESPINASSE, pp. 8, 16.

In 1813 Napoleon tried to instil cohesion and confidence in his battalions of recruits by giving them guns, and even after this last spasmodic attempt there were still some artillerymen who were not inclined to abandon regimental artillery altogether.

REAPPEARANCE OF THE TENDENCY TO DISPERSION WITH QUICK-FIRING GUNS.—After the war of 1870, in which the Germans managed to put into practice, much to our detriment, the principles of the Empire wars, the employment of artillery in mass, to which they religiously devoted themselves on every battlefield, became practically an article of faith.

The battalion gun was never mentioned except as a curiosity of history. The adoption of quick-firers has now reopened the question.

The increased power of the weapon seems to foster the idea of dispersing artillery from the possibility of getting great effect with a limited number of guns. So from this possibility, which is quite conceivable in certain cases, we find people trying to deduce a normal method of employment. To generalise thus is very risky, and such reasoning apparently originates not in actual facts, but in the moral impressions produced.

Every improvement in armament reacts strongly in favour of the defensive, and induces a tendency to the splitting-up and dispersion of units.

Our regulations for service in the field oppose this idea most resolutely, laying down as an axiom that "a purely passive defence is doomed to certain failure, and must not be thought of for a moment."

French F.S. § 128.

This statement we find similarly expressed in both French and foreign drill-books alike. It is independent of the relative power of armaments; or rather, the greater this power, the more it holds good, and of this the late occurrences in the Transvaal have afforded striking proof.

It is not our part to discuss the causes of this fact. It will be enough, from an artilleryman's point of view, to declare that the defensive is indissolubly bound up with the system of splitting up the units available which has been called the cordon system. To the superficial mind the more powerful the components of the cordon the surer is the guarantee of security.

It was in answer to this feeling that the volunteers of 1792, in the army of the Rhine, successively stationed

in their outpost line at Little Steinfield, 4, 8, 12, 16, and, at last, 24-pounders.

It is the same feeling which to-day makes us want to distribute our quick-firers over the whole fighting front.

The experience of 1870 rudely showed us that defensive cordons were as disastrous with the Chassepot and rifled gun as in the days of the flint musket and smooth-bore.

The fact remains unalterable that any line, no matter what its strength, will always be broken at the point where the enemy has been able to concentrate superior forces.

It remains, therefore, that quick-firing artillery must be employed in masses, exactly as smooth-bore and rifled guns have been in the past. To disperse our guns deliberately is to sow the seed of melancholy disillusionment and irretrievable disaster.

The causes which led to the battalion gun, of smooth-bore days, being abandoned remain the same to-day, but in addition there are three other reasons, referring specially to quick-firers, which derive their importance directly from the increased power of the gun.

Perfecting of the Weapon.—Full justice cannot be done to the gun, except in the hands of an experienced leader, that is, an officer, or very capable N.C.O. Now the resources of *personnel* are not so inexhaustible as to allow of scattering such men broadcast.

Difficulty of Ammunition Supply.—The increased gun power is the result of rapidity of fire, and will only be maintained as long as the supply of ammunition is assured. Now it is difficult enough to insure the replacement of ammunition to batteries or even still larger units. If guns are split up singly it is a physical

impossibility to do so, and the highly-perfected weapon becomes a mere encumbrance.

Besides, with single guns commanded by N.C.O.'s or young officers, without the authority to resist the frequent appeals of the senior officers of other arms on either side of them, the waste of ammunition would be something terrible.

NECESSITY FOR ALL ARMS, UNDER EITHER ARTILLERY OR RIFLE FIRE, TO MOVE UNDER COVER.—Whatever mobility and manœuvring power artillery may possess, it cannot take its vehicles along the same paths as the infantry. There would be a risk of the guns getting left behind or revealing the infantry's presence, and so drawing hostile fire upon them, instead of playing the part of their protector.

If the powers of a gun are to be fully exploited, it is quite inadequate to send only one wagon with it; but then, if it is possible for several vehicles to advance without showing themselves, why not send an entire battery?

Within the last few years attempts have been made to introduce regimental artillery in the modified form of machine guns. As the quick-firer may be compared with the machine gun up to a certain point, especially as to manipulation, the partisans of regimental artillery have seized on this fact as an argument for using both in the same way.

Without going into the technical part of the question, it is evident that the employment of machine guns is altogether abnormal, and it would be erroneous to make them an excuse for the general adoption of battalion guns.

This conclusion agrees with the opinion expressed by Sir Redvers Buller, after the English manœuvres

in 1899, when his criticism took the following form: "Better use is made of machine guns, but there is still a tendency towards employing them without interruption, to sending them forward in the infantry firing line, and towards bringing them into action in places whence it is difficult to get them away. Their tactical employment is too subordinate to the tactics of their respective battalions, and much advantage would be gained by letting them manœuvre more independently."

A Criticism of the English Manœuvres in 1899, by Gen. Sir R. Buller (*Cercle Militaire*, Oct. 21st, 1899).

This opinion, which supports the theories we are advocating, carries all the more weight coming from an army that has adopted machine guns for some years, and appears to value them very highly.

Although the principle of employment in mass must be maintained with the quick-firer, and though its systematic use as a battalion gun must be religiously shunned, it is nevertheless undeniable that the judicious employment of a section, or even a single gun, may be of the greatest service under exceptional circumstances.

In such a case it would be very wrong not to make use of the individual power of the gun.

It is impossible, of course, to draw up an exact list of such occasions, which will present themselves according to the march of events. It may be a case of dropping on to a road followed by an enemy's column, or perhaps one or two guns may be detached from the general line of batteries, to occupy a cramped position whence particularly effective fire can be brought to bear, either on the same target as the batteries, or a special one of their own.

Such instances as these are of very frequent occurrence at manœuvres. But it is only fair to add that in most of them, if the artillery commander had sufficient batteries at his disposal, he would be more likely to

detach a whole battery for the purpose than one or two guns. Whatever the situation, a gun or a section that is detached must not be left entirely to itself as a rule, but remains under the orders of the battery commander. Within these limits only will it be possible to utilise the individual power of a gun or section.

This power will be equally available for protecting the flank of a line of artillery. With non-quick-firers, when a line of guns was enfiladed, it was necessary for the flank guns to change front in order to bring effective fire to bear, which was a most laborious and dangerous operation, and impossible to carry out if the position was on a narrow ridge.

With quick-firers, one or two guns swinging their trails round to the right or left will probably meet the danger sufficiently. The manœuvre is very rapid and easy to execute,[1] especially if the regulation position of the gun and wagon are not absolutely maintained.

The heavy battery that formed the left of the artillery line of the IV. German Corps on August 18th, was decimated by the fire of a French machine gun battery, which had taken up a position in front of Amanvillers. Had it consisted of quick-firers it would assuredly have been able to maintain the struggle, by placing one or two guns crossways on its extreme left.

METHOD OF EMPLOYMENT IN MASS. PRINCIPLES GOVERNING CONCENTRATION OF FIRE AND THE ECONOMY OF FORCE.—Every one has long been agreed as to the necessity of establishing a superiority of fire from the very beginning.

"To attack the enemy without taking advantage of

[1] Judging by reports of the French manœuvres, this is hardly the case—and the author appears optimistic on this point. (TRANS.)

fire," said Frederick II., "is to fight an armed man with a stick. The discovery of gunpowder has entirely altered the system of making war. Nowadays it is superiority of fire that decides the victory." *Journal des Sciences Militaire* (June, 1899).

This superiority is to be gained by the use of masses, but opinions differ when it comes to deciding as to the particular method in which they shall be employed.

The German drill-book on almost every page represents the *number of batteries* as the primary element of success: "In most cases it is important to deploy from the very commencement a larger number of guns than the enemy, and to act in mass as early as possible." German F.A.D. § 279.

As a means of establishing a superiority of fire, it attaches as much importance to numbers as to rapidity of fire, if not more. To develop local superiority against particular portions of the objective, when numerically weaker in guns, it advises concentration of fire. *Ibid.* § 315.

The principle laid down by the German drill-book is that the entire bulk of the artillery should be engaged from the very first; the object being to establish in this way such crushing superiority, that the enemy's batteries, even if capable of refitting, may be unable to resume the struggle from another position until after a considerable interval and with greatly diminished *moral*. This is equally the spirit of our field service regulations, which direct that at the very outset artillery should bring every means at its disposal into play, reckoning the number of batteries as the principal factor of success. In the new edition, dated March 29th, 1900, article 135 still further accentuates the ideas expressed in the former volume.

Our drill regulations, which appear, by the way, to have served the Germans as the model for their own, contain almost identical directions as to concentration

of fire and the deployment of batteries. At the same time, it may be argued that the regulations of 1898 apply to non-quick-firers, and not to the true quick-firing guns. But, it may be asked, are we to interpret the expressions "engaging, bringing into line, coming into action," literally? Do they mean opening fire? The partisans of the individual power of the quick-firer are not of this way of thinking. According to their ideas, preparation is the vital element of success, rather than numerical superiority. There is no longer need, they say, for concentration pure and simple. The number of batteries to be brought into action depends entirely on the extent of front to be engaged, as we have remarked before.

The remaining batteries would be kept in hand or "retained," and would prepare their attack. In a word, they would make all their dispositions either to take the place of batteries that had already been engaged and silenced, or to open fire instantly on any targets that might appear later on.

LANGLOIS, Vol. II. p. 412.

Thus we find the principle of *husbanding one's resources* applied to the employment of the artillery mass. It is by no means a novelty, and would have fatal results if, from a faulty conception of the properties of quick-firing guns, we made it a hard-and-fast rule. In any case it should be clearly understood that batteries which are "retained" and held back in this manner must be ready to hand. They must be in a position to open fire instantly, and have nothing in common with the old artillery reserves.

This plan of retaining batteries answers a double purpose; it avoids using more force than necessary to demolish the enemy, and obviates the useless exposure of one's own batteries to probable destruction. As far

as can be predicted from the powers of the quick-firer, a battery showing itself prematurely to hostile artillery that is better prepared is doomed to annihilation, or, to say the least, in the gravest possible predicament.

In the presence of the enemy, menaced by that mysterious power ready to fall like a thunderbolt, it is easy to understand the sense of not exposing more batteries than are necessary for the task in view. Now, is this twofold object attained by the device of keeping batteries in hand? In theory it is, if we neglect the co-operation of the other arms, and consider the action in the light of an experiment on the practice ground. In this piecemeal system the two opponents would destroy each other's batteries bit by bit, and the victory would be to the one who could last produce an intact battery. But it hardly appears as though in reality things would happen with such mathematical precision. We must take into account the faults and mistakes of every kind, the difficulties of ranging, etc. It is by no means certain, judging from practice and manœuvres, that in an artillery duel, where both sides are armed with quick-firers, one will inevitably wipe out the other in a short space of time. Such is not the opinion of General Rohne. Neither does General Schlichting believe in this theoretical annihilation, and is making fun of it, when he likens two opposing forces of artillery to the lions in the fable, which ate each other up, so that nothing was found but their tails.

We already know why it is that we cannot count for certain on the individual power of the quick-firer, which is at the root of the idea of keeping some batteries in hand.

It must be added that by confronting quick-firing artillery with artillery of equal quality, but double the

numerical strength, we get twice the odds in our favour, as the chances of missing are proportionately diminished. Besides, from fear of losing batteries, is it good tactics to deprive oneself of their assistance in overwhelming those of the enemy? The annihilation of the foe is the goal at which we aim, and a partial destruction of his forces at first augurs well for subsequent success.

How are we going to bring into play the batteries that have been kept back? They may be deployed behind the crest, out of sight of the enemy (this is essential), with a section of the ground told off for each to observe—they will then become "observation batteries," whose *rôle* has already been described. Or they may be kept in rendezvous formation, in carefully concealed positions behind the crest, where they will hold themselves in readiness to take up the position which the officers and layers have already occupied, or to fulfil any other mission which may devolve on them.

The first mode of action has many attractions when discussing the matter in the abstract; for artillery so placed is *theoretically* ready to bring fire to bear on any portion of the ground it is observing.

But can we be certain that the batteries which are deployed behind the crest, without firing, will be hidden from the enemy's view? It is quite possible to be defiladed from a point or even a ridge, but not from a whole horizon line, along the heights of which the enemy himself may have concealed guns or observers. In that case these observation batteries may be wiped out themselves, without firing a shot, and without having assisted to destroy such of the hostile batteries as could be seen. Again, if all the "retained" batteries have unlimbered behind cover, and it happens that any

appreciable number of infantry manage to reach the dead angle unperceived, which will be frequently the case with the long-range fire of to-day, it will be necessary to limber up in order to advance the batteries to the forward slope. The movement would have been quicker and safer to execute if the batteries had been "retained," but kept in rendezvous formation in rear.

For this reason, it will often be wiser and will pay better to keep batteries in rendezvous formation, and not to deploy them behind the crest, though there is no hard-and-fast rule in the matter. As we shall see later, this conclusion is supported by an entirely different train of reasoning.

To sum up, the principle of husbanding one's resources runs counter to that of concentration,[1] and we see what complex problems have to be solved in applying it, what discretion and tactical skill are necessary to their solution. At the same time, it is desirable that it should be noticed in the regulations, if only touched on by way of experiment.

In any case, the solution of the problem on the ground, face to face with the actual situation, will always be one of an artillery commander's most difficult tasks.

ARTILLERY RESERVES.—Smooth-bore artillery, with its restricted range, once it was engaged, could exercise no influence on any but a small part of the battlefield. It ended in being pinned to the ground 500 or 600 yards

[1] "It is imperative to employ batteries by regiment or by brigade division . . . single batteries in action are exceptional." (German F.A.D. § 279.)

The French F.A.D., though dealing with the non-quick-firer, makes use of almost the same words. "Artillery comes into action by brigade divisions, and only exceptionally by single batteries." (§ 419.)

from the enemy, just as infantry is at the present time. Being no longer at the disposal of the General commanding, the latter was obliged to retain some artillery in reserve.

D'URTURBIE, p. 263. With this end in view, D'Urturbie advised the retention of a "well-horsed" body of artillery in reserve, behind the centre of the first line, capable of pushing rapidly forward, the better to "reinforce the point of attack."

GASSENDI, p. 1148. According to Gassendi, this reserve should be composed for the most part of 4-pounders.

These recommendations accurately explain the reasons for constituting a reserve—namely, the necessity for having a body of artillery always available for immediate employment wherever it was most wanted. There was no question of assigning this duty to the field guns of large calibre, as was done later through a misinterpretation of a sound idea.

It is important to make it quite clear under this head that the eighteenth century artillerymen had no thought of taking the words "in reserve" to mean "unemployed." "Do not leave any part of your artillery idle," Du Puget tells us.

DU PUGET, p. 44.

The employment of artillery reserves in this way was introduced during the wars of the Empire. "This," says General Rohne, "was Napoleon's method. The artillery allotted to brigades and divisions opened the engagement and prepared the attack, which it accompanied as far as possible; then, at the moment of assault, the bulk of the artillery reserve threw all its weight on to the decisive point, pushing close up to the enemy and covering him with grape.

"This conception," adds the General, "was admissible as long as artillery fire was ineffective at long ranges."

But it becomes hopelessly out of date with long-range guns that can make themselves felt, without changing their position, over the whole fighting front of an army corps.

Besides, as noticed by Prince Kraft, "the greater the range at which artillery is engaged, the less it is committed, and the more it remains, even during the progress of the fight, at the disposition of the General commanding. He can still order them to limber up and employ his batteries elsewhere." 15th Letter.

In other words, with long-range guns, the reserve of artillery could be considered as formed by the artillery in position. It followed, therefore, that, agreeably to the leading principle, that in war no force should remain idle, the whole of the artillery had to be engaged from the very first.

The mass thus employed was to crush in detail the batteries which the enemy might bring into action one after another, and could, besides, provide the batteries necessary for the different phases of the fight.

Not realising up till then the necessity for this alteration, the Prussians maintained their artillery reserves in the war of 1866, in consequence of which these were relegated to the tails of the columns, and almost always arrived too late to be of any use. "Even when the fighting was at its fiercest and the struggle most critical, we could not rid ourselves of the inclination to keep some artillery in reserve, as though they were cavalry or infantry." 2nd Letter.

In France we had kept to the old system of reserves belonging to smooth-bore times. As a general rule, the army corps reserve batteries were never engaged until the divisional artillery had been silenced by the

German guns, which were greatly superior in numbers and equipment.

Need we recall the tardy employment of the forty-eight guns of the first corps artillery reserve at Froeschwiller? Need we dwell on the retention of the greater part of the guard artillery and the general reserve of artillery at Plappeville, while the unhappy 6th Corps, left to its own resources,[1] was crushed at Roncourt and Saint-Privat by the converging fire of 144 German guns, and fell a victim to the efforts of two German army corps.

The timely intervention on the scene of action of the masses of French artillery held in reserve at Froeschwiller and Plappeville, on August 6th and 8th would no doubt hardly have altered the entire aspect of affairs; but it might at least have averted the disaster in part.

The adoption of the quick-firer has produced a reaction of ideas towards the system General Rohne calls "the Napoleonic method." The advocates of this return to the reserves of old days are evidently afraid that, by committing all their artillery from the outset, they risk having them annihilated, or pinned to the ground once

[1] Thirty-two thousand men and 74 guns, according to the German official account. Since the morning Marshal Canrobert had continually appealed to Bazaine for support. He asked especially for artillery—both ammunition and batteries. He appears to have received no help during the battle but the following: 4 wagons brought up from Woippy by Captain de Chalus of his own staff; 3 or 4 wagons which, to use his own expression, General Ladmirault sent him "as a friend"; 2 12-pounder batteries of the General Reserve, which General Soleille sent him at 3.30 p.m. by Bazaine's order; and 4 horse batteries of the Imperial Guard artillery reserve, which Bourbaki, on his own initiative, had sent up with the grenadier division. Total, 8 wagons and 6 batteries! Besides which these figures contain the saddest irony of all. The batteries that were sent arrived too late, and did nothing but cover the retreat!

they are in action. They want at any price to maintain a body of artillery intact for the purpose of manœuvring and continuing the engagement, regardless of the issue of the earlier phase. They endeavour in this way to avoid the same danger against which the partisans of "retaining" batteries think to provide by their system.

But, in the first place, does it follow that the power of the quick-firer neutralises that property of being "always available" which artillery has gained from the increase in range?

It is by no means certain. From the very fact of the deadly power possessed by the new *matériel*, the opposing artillery will do all in its power to avoid its consequences, making use of concealment, long-range fire, and cover. The incidents of the combat will follow each other in quick succession, brought on by the combined efforts of the three arms; and it would be rash to declare that batteries, even when silenced by hostile artillery, could not withdraw out of action with the help of such diversions, especially if they occupy a position behind cover. There are no grounds for the comparison as regards the point in which we are interested, of artillery in position at 3300 yards, or even further, from the enemy's guns, however powerful, with smooth-bore pieces only 500 or 600 yards away—that is to say, in full view and within easy case-range of the enemy's line.

General Rohne does not deny the possibility of batteries that have had the worst of it withdrawing to refit; but he thinks that they will be unable to take any further part from a new position for some considerable time, and that loss of *moral* will diminish their efficiency. But it does not seem that these suppositions are necessarily justified by the adoption of quick-firers, as the General avers.

At every page of the history of the war in 1870 we read of batteries that have suffered heavy loss withdrawing to refit.[1] It is true that these movements, as then carried out, were the outcome of mistaken principles, and with quick-firers they would constitute serious errors, but for the time being we are considering only the possibility of refitting. Why should this be more difficult of accomplishment to-day than formerly, especially when we consider that it is effected by borrowing materials from the second line; in other words, men that have so far taken no part in the mortal struggle.

Revue militaire de l'etranger (March, 1900).

General Rohne categorically forbids the use of artillery reserves. Half-measures, as he says, have *never been of any use in warfare.* True; but we must not conclude, as the vigorous arguments of the General would lead us to suppose, that it is invariably wise to put all our eggs into one basket and commit the whole of our artillery from the very beginning.

Artillery will always keep some of its strength in reserve.

Even if it be a fact that artillery, once it has taken up a position, is less adaptable when armed with quick-firers than with the slower-firing guns of 1870, a smart corps will still preserve this faculty to a great extent, and will consequently keep something upon which to fall back. Besides, when every battery belonging to the army corps engaged has been brought into action, there still remain considerable forces of artillery to be disposed of

[1] Examples. On August 18th, 4 batteries of the IX. German Corps, out of 6 which had retired from the contest after suffering heavy loss, were able to refit—namely, one with 4 guns, one with 5, and the other two all 6 guns (G.O.A., p. 704). After an hour or an hour and a half these batteries were able to resume the struggle. See also p. 50.

in the batteries of the corps that are not engaged—that is, those in second line.

This was precisely the use that the Germans did make of these batteries in 1870. Thus in the evening of August 18th, between five and six o'clock, six batteries of their III. Corps, in second line behind the centre of the German army, came up to reinforce the firing line of the IX. Corps, which was exhausted and engaged to a man. Similarly, the batteries of the 5th Cavalry Division and the X. Corps, in second line, making 16 batteries in all, came up about seven o'clock and reinforced the artillery of the Prussian Guard before preparing the attack on Saint-Privat. G.O.A. p. 820. G.O.A. p. 854.

This scheme of keeping in reserve the artillery of the large units in second line was admirably explained in our *Instructions of May 1st, 1887, on the Employment of Artillery in the Fight.*

"The artillery of divisions or army corps forming part of the general reserve," said this Manual, "takes part in the contest as soon as it arrives on the scene of action. . . . Such units may place their artillery quite close to the heads of their columns, even right in their van."

MOBILITY OF ARTILLERY. The massing of artillery in big batteries is closely connected with its mobility. The want of mobility was the principal, perhaps the only real, obstacle to the realisation of the true method of employing artillery in the fight.

It was the argument of those who, in Vigenère's time,[1] wished to see cannon relegated to siege work and abandoned in field operations. It was the same thing which made Machiavelli say, "the artillery should fire a single broadside before the hand-to-hand struggle." It was the cause, according to Vauban, of the refusal of many FAVÉ, Vol. I. p. 249. FAVÉ, p. 139.

[1] 1523–1596.

Vauban's Memoirs, FAVÉ, Vol. IV.

cavalry and infantry officers, "to subordinate their movements to those of the artillery." It indeed justified the repugnance of Frederick the Great, who, "far from looking on the arm as a means of ensuring victory, regarded it as an obstacle to the rapidity of his operations."

DECKER, *Seven Years' War*, p. 91.

Numerous attempts, which we need not now recall, were made after the sixteenth century to retrieve the stick-in-the-mud character of artillery. These endeavours were significant, but incapable of tactical application to any great extent in the defective state of equipment and *personnel* of those days. It was not till the latter part of the eighteenth century that the progress made in both points endowed artillery with mobility, the foundation of its employment in field operations. In France, it was Gribeauval who started our artillery in the right direction, and he bequeathed to Napoleon an implement wonderfully apt for the purpose to which it was devoted by that master-mind.

The short-range smooth-bores had to follow the infantry in their advance into action so as to continue firing. In answer to this requirement they were manhandled with drag-ropes and, at practice, the guns were hauled at the rate of 100 paces a minute for 150 paces at a time, delivering a rapid fire after each advance.

SCHARNHORST, Vol. III. p. 92.

Increased range allowed artillery to maintain its position and continue firing during the infantry advance.

By mobility we must not understand an aptitude for brilliant evolutions, but above all the power of making long and rapid marches.

With this idea in view Prince Kraft expressed a wish to see all his batteries organised as horse artillery—not, indeed, that they might perform pretty manœuvres, but so as to form a mobile body which could operate with ease

at great distances and move across country if required. This is actually the part which the German drill-book assigns to horse artillery to-day. "Horse artillery," it says, "exclusive of its employment with the cavalry divisions, affords special facilities for rapidly reinforcing any threatened point, or seizing any favourable opportunities during the course of an action." German F.A.D. § 288.

Mobility gives artillery such power of manœuvring that in the days of non-quick-firers it could to some extent atone for numerical inferiority.

In 1870 the French gunners were sharp enough to exploit this capacity to its utmost. Here are two characteristic examples: Rousset, p. 203.

After the surprise of Beaumont, five French batteries, of which two were mitrailleuses, had retired to the heights north of the village and managed, "by dint of constantly changing their positions, to withstand the superior numbers of the German guns—that is, twenty-five batteries." G.O.A. p. 1009.

At Sedan, after the capture of Bazeilles, the French batteries "did their best to cover the retreat of the 12th Corps, by repeatedly changing their positions." *Ibid.* p. 1124.

The German official account, in its analysis of the different methods of fighting of the three arms in the war of 1870, pays a striking tribute to the French artillery, which it describes as "possessing in a high degree mobility and manœuvring power."

Would such manœuvres be possible to-day in the face of quick-firing artillery? It is exceedingly doubtful. P. 24.

We have seen that in 1870 the Germans were in the habit of withdrawing batteries that had suffered severely, or expended all their ammunition, to allow them to refit and resume their position afterwards, instead of

doing so where they were. The moral effect of this practice is lamentable.

As Prince Kraft rightly says, infantry and cavalry may retire for a time, without producing any great effect, "but these two arms are accustomed to consider the artillery as their great stand-by, and the thunder of its guns is for them a guarantee that things are going well. Consequently, when an infantry man or trooper sees artillery falling back, he imagines that the action is being broken off, and that the battle is considered lost."

PRINCE KRAFT, 5th Letter.

Then again, such movements as these entail the critical operation of limbering-up at the very moment when the enemy has established a superiority of fire. It may even happen that, after they have refitted, batteries may lose their sense of direction in the confusion of the fight, and wander aimlessly about without ever getting back to their old position, like the heavy battery of the IX. German Corps on August 18th. This battery, after refitting in the wood of la Cusse, took a wrong turning in coming back to the fight, was caught by heavy rifle fire from the French infantry, and disappeared for good and all.

G.O.A. p. 705.

§ 384. After the war the Germans realised the dangers of such procedure, and their drill regulations contain the most stringent injunctions on this point. "A battery that has expended its ammunition," it says, "does not retire, it awaits the arrival of ammunition where it is." [1]

[1] Prince Kraft, in his 5th Letter, cites rather an original device of the officers of a German battery at Chateaudun to keep their gunners from getting impatient, while waiting for ammunition to arrive: "The officers mounted their men on the limbers and made them chant the *Wacht am Rhein* to pass the time agreeably." The battery doubtless could not have acted in this manner had it been under hostile artillery fire of any importance.

"Batteries under fire are not relieved, but reinforced by the arrival of fresh batteries. Even severe losses are no excuse in themselves for abandoning the position." The terms of our regulations are almost the same: "As a rule, a battery must never retire when under fire, without a distinct order, however it may be situated as regards ammunition, and regardless of any loss it has suffered. It will, in this case, maintain its position, so as to keep the enemy in dread of a reopening of fire."

The employment of quick-firers the action of which, once superiority has been established, results, as we know, in paralysing the enemy's artillery, lends particular weight to the foregoing directions.

Batteries in position, therefore, are never to retire (always supposing it to be possible) except for the purpose of being employed elsewhere at the disposition of the commander, and not under pretext of refitting.

The impossibility, on the one hand, of manœuvring in presence of hostile batteries, armed with quick-firers and free to make whatever use they please of their fire; and, on the other, the sort of paralysis with which batteries in action are affected, might seem, at first sight, to diminish the importance of the manœuvring powers of artillery.

This opinion would tend to make one treat field artillery as a sort of position artillery; it would be most disastrous, and would put back the employment of the arm more than a hundred years.

Mobility and manœuvring skill are still the primary qualifications of any field artillery worthy of the name, quite as much and even more than in the past. But they must be exercised by different methods to those in vogue with the older pattern guns.

The superiority of quick-firing artillery, which

possesses mobility and manœuvring power, will be displayed in making its way unseen, during the movements preparatory to the occupation of position, in the occupation itself and in the withdrawal from action of batteries that are to be held at the disposal of the commander.

SECURITY OF ARTILLERY.

IMMEDIATE SECURITY—ESCORTS.—The moment artillery became an important factor in field operations steps were taken to ensure its security.

In France this was at first the privilege of the Swiss; then in 1671, when Louis XIV. gave a military organisation to the artillery, he formed the Regiment of King's Fusiliers, which was specially charged with the care of the artillery.

Such was the origin of the Royal Corps of Artillery, from which are derived our present regiments.

With short-range smooth-bores artillery was obliged to remain near the other arms and looked to them for protection.

The adoption of long-range rifled guns modified the situation. For artillery without altering its position could continue its part in the struggle, whilst the other arms were manœuvring and getting further away; thus it had no immediate protection, and provision had to be made for special escorts.

In 1870 the Germans made an invariable rule of giving special escorts to the artillery. They left one on August 18th, for the artillery of the I. Army, separated from the adversary by the deep, wooded, and almost impassable ravine of La Mance, when their infantry had already got a footing on the left bank.

However, when the infantry of the II. Corps, in second line, was crossing the Mance, and a pressing need was

felt for fresh troops to support the attack on Point-du-Jour, a battalion acting as escort to the artillery was indeed requisitioned for the purpose. But the German Head Quarter Staff seems to think it necessary to justify such a measure, as it says, "The artillery commander had given his opinion that, under existing circumstances, he could do without this battalion." G.O.A. p. 807.

So careful were all their leaders about artillery escorts that, whenever they considered batteries belonging to other corps exposed, the Generals on their own initiative would find an escort from their own troops.

Thus at the time of the attack on Saint-Privat, the commander of the X. Corps, in second line in rear of the left of the German army, thinking the right of the long line of artillery situated south of Saint-Privat was too much in the air, sent them two battalions as escort of his own accord. Meanwhile the commander of the 20th division similarly sent two companies to the left of the same line, which was composed of batteries not belonging to his division. G.O.A. pp. 854-8.

So the escort was ensured during the assault. Is it not indeed necessary to consider the possibility of the latter being repulsed, or of a counter-attack by the enemy, even if the assault has succeeded? In either case, is it not essential to protect the artillery from a *coup-de-main*, to which it might fall an easy prey, when occupied in covering the retreat of other troops?

This idea of the need for a special escort prevailed for a long time after the war. The instructions as to the employment of artillery in the fight of May 1st, 1887, speak of it as a measure to be taken as a matter of course.

Then came a change of opinion. It doubtless seemed inconsistent with the true principles of employing one's

forces to keep a body of troops idle in case the artillery might need protection. The instructions for the service of artillery in the field, dated December 24th, 1896, directed that special escorts were not to be found for artillery except in peculiar cases; and the 1898 drill-book confirms this view, saying that the escort is furnished in case of need.

The German Manual is still more explicit. "As a rule," it says, "artillery is not given a special escort."

Taking it all round, then, it seems officially recognised that the security of artillery is to be left to the care of troops in the vicinity. How different to the practice so scrupulously followed in 1870!

The exaggeration of this new tendency is not without its dangers.

From the fact that artillery can continue to act effectively without changing its position, or because the ground in front affords no better one, it will be likely to stay where it is, while the infantry is advancing. In this way contact will be lost with the other arms, and then will happen what so often occurs at manœuvres—the capture of batteries by a bold stroke. This is the very part which the drill-book so particularly assigns to cavalry.

Security at a Distance.—Manœuvring Zone.—The security of artillery must be ensured otherwise than in its immediate vicinity. It needs some sort of distant safeguard to provide it the manœuvring zone, which it must have to deploy and open fire.

This safety zone is necessary, not only on the march but also during the fight.

The Germans, though so strict about special escorts in 1870, did not take the same trouble about the manœuvring zone. This carelessness cost them dear at

times, witness the artillery of the IX. Corps. In many cases it would have entailed utter disaster had they but been opposed to an adversary with a dash of enterprise.

It was but the merest chance that Saint-Ail was not occupied by French infantry when the Guard artillery came into action to the south-east of the village. If a German battalion had not got there just before a body of Frenchmen, who were making for it at the double, the first Prussian batteries to arrive on the position would have been very awkwardly situated indeed. "For a considerable time the left flank of the artillery line had no one in support but the Guard Regiment of Hussars." PRINCE KRAFT, 12th Letter.

In the VIII. Corps, before Point-du-Jour, the Germans took care to give the artillery an immediate escort, but did not secure it the manœuvring zone.

It was due to the initiative of a brigadier that the infantry pushed forward and dispersed the handful of French snipers, who were in the woods on the right bank of the Mance. Had these been seriously occupied, the German batteries would have been decimated before firing a single round.

At Sedan the whole of the Saxon artillery was deployed unsupported, and was soon so hard pressed by the French skirmishers that it retired again. In the face of hostile artillery armed with quick-firers such a movement would have meant disaster.

At Sedan, again, the whole artillery of the V. and XI. Corps was curiously adventured. The Headquarter Staff scarcely conceals its dismay at such rank imprudence: "The batteries of the XI. and V. Corps, which had to negotiate the dangerous defile of the La Falizette wood, waited for no support, but, confident in their own

strength, came and formed a long line, between the Belgian frontier, at their backs, and the masses of French cavalry which were threatening them in front."

Just imagine the effect of the four French cavalry divisions massed on this part of the field—namely, Margueritte's, Bonnemains', Brabant's, and Ameil's, supported in rear by the 7th Corps, if they had pounced on these batteries supported by only a battalion or two! While capturing some they would have driven the others back in confusion on to the defile of La Falizette, which was choked by the columns of the V. and XI. Corps. It might have meant the overwhelming of these corps and the opening of the road to Mezières.

It is only fair to add that on other occasions the Germans did provide their artillery with the requisite safety zone.

It will suffice to cite the deployment of the artillery of the VII. Corps, carried out on August 18th under the protection of the infantry, which had occupied the wood of Vaux the night before. Similarly, the regiment sent by the commander of the XII. Corps, at the battle of Beaumont, to occupy the cluster of woods 1600 yards in front of the exit from Dieulet forest, so as to cover the deployment of the artillery. Lastly, the deployment of the Guard infantry at Sedan, prior to that of the artillery, thus assuring the latter its zone of security.

G.O.A. p. 743.

Ibid. p. 1005.

Ibid. p. 1130.

Need we remark that, just as on the march, the employment of quick-firers renders the safety and manœuvring zone even more essential than before.

MATERIAL PROTECTION. EARTHWORKS. GROUND SHIELDS. In the days of smooth-bores, which had to follow the infantry at every step, it was not feasible to make use of earthworks in action to any appreciable

extent. This practice may be regarded as the outcome of the increased range and power of firearms.

In the war of 1870 there are many examples to be found of material protection provided in this manner.

The German official account clearly thinks it necessary to find excuses for the artillery of the IX. Corps, which threw up no earthworks on August 18th. "We may feel sure," it says, "that during the course of this engagement, lasting several hours, the unfavourable nature of the soil made it impossible to dig gun epaulments." G.O.A. p. 674.

Objection has been made to the throwing up of earthworks as being prejudicial to offensive movement. Yet Skobeleff, who was a good enough exponent of the offensive, but remembered the experiences of Plevna, Skobeleff, after witnessing the German manœuvres of 1879, wrote that the German infantry was too much inclined to despise fortification, relying too much on the recollections of 1870, when it possessed such crushing numerical superiority.

Things have gone ahead somewhat since 1879.

At the grand manœuvres of 1897 General von Haeseler, one of the most energetic and prominent of the German Generals, organised defensive works on September 7th with several tiers of shelter trenches. He caused hasty epaulments to be dug for the artillery by the pioneers.

In the Greco-Turkish war of 1897 there was a lot of digging on both sides, even by the assailant. Gun epaulments were constantly made use of by the artillery.

The present German drill-book seems to make a great point of diminishing the vulnerability of artillery when in action. It recommends the use of earthworks on all occasions, even on the offensive, and directs that they

be extensively used in the preparation of defensive positions. With the same end in view it orders that the detachments shall be made to kneel down.

German F.A.D. § 286.

However, notwithstanding the significance of these facts, and in spite of what is laid down in the regulations, they have little liking in Germany for the protection of guns by epaulments. In admitting this, General Rohne declares that they hinder the firing, and give the enemy a distinct point to range on, and so do more harm than good.

ROHNE, p. 121.

The German drill-book, which favours the protection of guns by artificial cover, that is, earthworks, will have nothing to do with the natural protection given by the ground itself, all on account of the laying, as we have already seen. This contrast is interesting to notice.

In the three actions of 1870 which we have studied, the Germans only once made use of natural cover for their guns, and, even in that case, it was a mere matter of chance, as the batteries which benefited by it had no idea of being enfiladed on their left flank. It was on the famous ridge which ran out into the French position, and on which the artillery of the IX. Corps exposed itself to destruction piecemeal. The first brigade division of field artillery, as the German account tells us, got off lighter than the others, thanks to an almost imperceptible fold in the ground.

G.O.A. p. 674.

Our French drill-book gives a sealed pattern epaulment. This seems to be making for too great precision. There is no need for a regular fortification, but merely a light protecting screen, thrown up with rapidity.

After all, the use of natural cover and adoption of shields does away with the necessity for so much digging. In cases where a battery comes under oblique fire, the wagon will be placed at an angle on the exposed

side to cover the detachment, which is far quicker to carry out than the simplest earthwork, and affords certainly as great protection.

If the German batteries of the IX. Corps had possessed shields for their guns on the plateau of Amanvillers, there is no doubt but that they would have escaped their heaviest losses.

CHOICE AND OCCUPATION OF POSITIONS. It would be out of place here to give a list of all the points which a good artillery position should possess. Every officer must of course bear in mind these points when reconnoitring a position, but it will be not so much with a view to choosing it as in order to determine how he may best exploit the advantages and avoid the disadvantages which it presents.

More often than not, as a matter of fact, positions will be forced upon one by circumstances, that is to say, by one's orders, by the ground, and by the enemy.

The actual emplacements for the guns will be all that is left to the discretion of artillery officers, and their skill will be displayed in making the most of a given position.

This is the meaning of the axiom, "There are no such things as positions," as far as it concerns artillery.

With the enormous masses of artillery which are brought into play nowadays, every bit of ground which is capable of holding a gun will be occupied. It remains for the gunners to obtain the best results from the ground they are obliged to hold.

Amongst the points of a good position there is one that we must specially notice, as the employment of quick-firers increases its importance; that is, *security*, which both the French and German drill-books place all but last on the list. Now, in presence of the new equipment this requires careful attention; at least in the

initial phase in which artillery is opposed by hostile artillery still intact and able to turn its fire on to anything at will.

The skilful occupation of a position is the first step towards making good use of it. The quick-firer makes the success of artillery dependent on this first operation, so the details of its performance become exceedingly important.

A faulty occupation of position, entailing further movement to put things right, would not have mattered so much with the old pattern guns, but when opposed by quick-firers a mistake of that kind may mean ruin.

It is impossible to make any rules on the subject. It can merely be said that in the preparatory phase a position behind cover is desirable, while, in the course of the fight, the case will best be met by coming rapidly into action in the open. But there is nothing arbitrary about it; circumstances may easily render it better to take up the first position in the open and the later ones behind cover.

German F.A.D. § 304.

In every case endeavours must be made to increase the value of cover by rapidity in advancing and coming into action. All the preliminaries of occupying a position must be studiously hidden from the enemy until the actual moment of opening fire.

POSITIONS OCCUPIED IN ANTICIPATION.

Another result of the quick-firers' employment has been a recurrency of the inclination to occupy positions in anticipation. I purposely use the expression *anticipation*, which implies a well-considered action following certain definite rules, and not *premature*, which applies to a hasty act, the outcome of bad judgment.

Those who believe in the anticipatory occupation of positions expect in this way to make certain of being

beforehand in preparing their attack. A battery told off as "in observation" is a particular instance of anticipatory action; its advantages and disadvantages we have already discussed.

Our Field Service Manual is explicit on the subject. "Care will be taken not to occupy the line of defence until the direction of the attack is ascertained." § 132.

The German drill-book is even plainer. Artillery must in most cases refrain from occupying the position in advance, "even if this has been artificially strengthened. This is the only way," it adds, "of insuring that the artillery meets the enemy in the right direction, and does not have to change its position prematurely."

Positions will scarcely ever be occupied in anticipation except in special cases, such as the defence of narrow defiles, where there is no doubt as to the position the guns will have to occupy. It may also be justified sometimes in a long line of artillery, where the guns have but a small section of the ground to cover, and fire more or less straight to their front; but here again there must be no question as to the position to be occupied, from whatever direction the attack comes.

If there is any uncertainty as to its direction, or if there is more than one possible position, it would be a mistake to occupy it beforehand. This applies particularly to artillery attached to small bodies, which may have to bring fire to bear over a very wide arc, 180° or more sometimes.

In any case, whenever artillery is stationed beforehand, it must be so arranged that, if not wanted, the batteries may be withdrawn and sent elsewhere rapidly and without risk.

On August 18th the artillery of the 14th German division gave an example of the occupation at the right

moment of a position which had been reconnoitred beforehand. This was all the more characteristic, as it took place in the attack, where the direction of their line of fire was consequently known beforehand. "Hidden from the enemy's view by a large fold in the ground," the German account tells us, "the batteries advanced at the trot in column of sections, between Gravelotte and the Bois des Ognons, and reached the position determined on the night before by the Brigade Division commander, Major d'Eynatten. They came into action so quietly and promptly that the first intimation the enemy received of their presence was the bursting of the shells in their midst."

G.O.A. p. 741.

At the action of Beaumont, on the other hand, three French batteries, by occupying Mt.-Brune prematurely, allowed the Germans to lay their plans for the attack of the heights with the greatest certainty.

General Zychlinski, commanding the 7th division, when making his reconnaissance, saw that the French artillery "had taken up a position facing east, in order to operate on the flank of the Germans, who, as they expected, would attempt to get clear of the wood of Givodeau. The eastern slope of the hill was under heavy fire, while the western slope, on the other hand, was quite undefended."

G.O.A. p. 1032.

CHANGE OF POSITION.—Every change of position is a critical operation during which artillery is most open to attack while at the same time unable to reply. So the first care of the German drill-book is to declare that "it should never be undertaken unless the situation demands it."

German F.A.D. § 340.

After making a very similar statement, the French regulations add the following advice, with the twofold object of deceiving the enemy and diminishing casualties:

"Abandon the position without the enemy seeing it, quitting it by the rear." French F.A.D. § 444.

It is nearly always possible to leave a position surreptitiously in this way, and it will be done even when batteries have to push forward beyond the position as soon as they have limbered-up. It is unquestionably less dangerous to cross the skyline at speed than to limber-up in full view of the enemy.

If the batteries are hidden from view by a ridge or other cover in front of their position, they will of course proceed in the reverse manner and limber-up to the front. The movement is carried out under the protection of batteries still in action, that is to say, by *échelons*.

As to what the distance between one position and the next should be, the German regulations give us no clue, but the French drill-book thinks it as well to say that "movements of less than about five hundred yards should be avoided."

It must be clearly understood that it is impossible to lay down any precise rules on the subject.

One or two examples will suffice to show what is meant, without further comment.

Seven batteries of the Prussian Guard had, as we know, taken up a risky position south-east of Saint-Ail. "When the occupation of this village and the progress of the advanced guard sufficiently insured the safety of the left of the line of guns, General von Hohenlohe directed his batteries to advance by *échelons*." G.O.A. p. 725.

The extent of this movement was hardly more than 200 or 300 yards, the reason obviously being "the position of affairs at the time and the dense clouds of skirmishers which there were in front."

During the attack delivered by the first German Army against the heights of Point-du-Jour and Moscou, the

artillery of the VIII. Corps, which at first had taken up a position west of the Gravelotte-Malmaison road, changed its position to one about 500 yards further forward. "It was impossible to advance further, for beyond that
G.O.A. p. 758. the ground fell steeply down to the ravine." Therefore, if the artillery had had to change its position a second time, it would have been obliged to push right across the La Mance ravine, covering a distance of over 1000 yards as the crow flies. Now, as the only way across for batteries was by the main road, this would have meant that some of them had to accomplish a distance of over 2000 yards. The movement by *échelons* may be effected either by bringing up the unit in rear alongside the one in advance, and then sending this one on again still further, or the part left behind may be pushed on right ahead of the other. In other words, units may advance in succession or alternately.

The second system entails a longer advance on the batteries than the first, but has the corresponding advantage of diminishing the time lost in coming into action, pointing out targets and opening fire; so, as a rule, it will be the most advisable. In any case, advantage must be taken of batteries changing their position to sort out any units that have been unavoidably mixed up in forming a long line of guns.

ARTILLERY FIRING OVER THE HEADS OF INFANTRY.

Frederick the Great's Instructions to his Generals.

"Except when forced by circumstances, you must never fire over the heads of your own infantry"; so ran Frederick the Great's advice.

But with long-range weapons this practice became feasible. At the same time, to use the terms of the *Instructions of May 1st, 1887*, for the employment of artillery in the fight, "The principal groups formed by artillery in the firing line were restricted with

regard to subsequent change of position to a very well-defined space . . . the intervals reserved for infantry being about 1100 to 1300 yards."

This was the system in which special sections of the line were assigned to each arm, from which followed arbitrary dispositions inapplicable to any but ideal ground.

The provisional instructions of 1896 on the service of artillery in the field abolished all this, laying it down as an axiom that "artillery has no fixed positions, and has no business to have special sections of the line told off to it; it almost always fires over the heads of the infantry." The regulations add, by way of information, that "when firing time shrapnel, it must be considered dangerous for one's own troops to be within 500 yards of the target or the muzzles of the guns." This distance varies also with the direction and degree of slope of the ground, and the above applies to a level plain; it varies besides with the nature of projectile and the curve of the trajectory.

The German regulations, with greater prudence, recommend that "firing over one's own troops should be avoided as far as possible; if it is absolutely necessary, it cannot be done too carefully." German F.A.D. § 285.

If the advice of the German drill-book were to be taken literally, considering the huge masses of artillery that accompany the deployment of modern armies, no room at all would be left for infantry to move in front of the batteries.

On the other hand, when the ground is flat the low trajectory peculiar to high velocity guns increases the extent of the dangerous zone. But we may observe that only in theory is the ground really flat. More often than not artillery occupies rising ground, at any rate

when acting in a long line, and it is proportionately easier to fire over the heads of troops.

In South Africa the British artillery often fired over their infantry.

At the battle of Magersfontein in particular, "with the exception of the horse artillery battery, the artillery fired over the heads of their infantry lying down in front of the guns throughout the day."

FROCARD and PAINVIN, p. 341.

While Lord Methuen's guns were raining projectiles on the Boer positions, the men of the Highland Brigade after their disastrous repulse, lay flat on their stomachs between the British batteries and the enemy's lines."

Ibid. p. 337.

The one thing, however, that must be absolutely forbidden is the system of telling off certain sections of the line to a particular arm, which is utterly prejudicial to a proper use of the ground. The best instructions on this point seem to be the French drill-book of 1898, simply because it allows all possible latitude in adapting dispositions to the nature of the ground and the tactical situation. In any case, it seems excessive to extend the zone on the near side of the target to 500 yards. If the artillery ceases firing when the infantry are within 500 yards of the objective, it will withdraw its support at the very moment when this is most needed. It will be better for the infantry to chance a few friendly shells than to be received at short range with a fresh outburst of hostile rifle fire.

To pass through a line of guns is always a delicate operation for infantry to perform, for the former must necessarily cease firing for a certain time. Advantage must be taken of the most favourable points for passing through, and small bodies of infantry will advance by rushes, so as not to interrupt the fire of the artillery altogether.

CHAPTER II.

ARTILLERY IN THE PRELIMINARY PHASE.

EVERY engagement is preceded by preliminary operations to clear up the situation without committing the commander decisively. This phase is heralded by the collision of advanced guards after the cavalry fight has taken place.

"On the advanced guards, comprising troops of all arms, devolves the duty of procuring the time and space necessary for the commander to collect the forces at his disposal and the information on which to base his operations. They may further be required to seize certain tactical points, of which the occupation is considered necessary to the future progress of the action.

"As long as the advanced guards only are engaged, they must leave the commander entirely free to accept a battle or refuse it." (*Field Service Regulations*, (§ 128).[1]

The more easily to discuss the employment of artillery in the fight, we will consider the part it has to play in the successive phases defined by our *Regulations for Field Service*—Preliminary, Preparatory, Decisive, and Culminating.

This does not imply that all questions which may

[1] The German drill-book defines in much the same words the part to be played by the advanced guard and its artillery in the preliminary phase. (§ 343.)

arise must be definitely considered under one or other of the above heads, for these processes do not follow each other with such regularity on service, or even at manœuvres. This is the meaning of the drill-book in saying that "these phases do not always preserve the same relative importance."

But there is advantage to be gained in treating the matter thus, for it brings into prominence the different duties incumbent on artillery during the course of an engagement, when acting in conjunction with other arms.

On August 18th, in the IX. Corps' share of the battle, there was, so to speak, no preliminary phase. The bulk of the artillery was engaged from the first moment of contact, neither was there any decisive action or culmination.

At Saint-Privat we find the principal phase to be the decisive attack, and no culmination.

At Beaumont, on the contrary, the whole action consisted in the culmination of the attack; and indeed, it was not until Mouzon was reached that the Germans really reaped the fruits of the surprise at Beaumont.

It would be useless to give further examples. But we will merely remark that in the actions of 1870 the preliminary phase was usually cut as short as possible. This was the direct result of the tactical methods employed by the two adversaries. The French, on the one hand, kept strictly to a passive defence, the Germans, on the other, took the offensive for all they were worth, and sent all troops into the fight the moment they arrived on the scene of action, to which they had been drawn by the sound of the guns.

ENGAGEMENT OF ADVANCED GUARD ARTILLERY.

The first act in which the artillery comes on, so to speak, is the action by the advanced guard batteries. As long as these have the stage to

themselves the commander still has the power of breaking off the engagement by sacrificing them if need be. But once the bulk of the artillery is engaged, the commander is committed to fight, and has lost his independence of action.

This fact alone is enough to show that the advanced guard batteries must be employed in an entirely different manner to those of the main body. These batteries have a definite part to play, closely connected with that of the advanced guard, and they may sometimes have to carry it through without counting on help from those of the main body. Sooner or later the advanced guard infantry, while still providing the safety zone for the batteries of the advanced guard, will be brought to a standstill by superior forces, or by a position that has been placed in a state of defence; or it may be too weak to seize a point that it is considered necessary to occupy. If left to its own resources, the infantry would thus be unable to fulfil its task, or could only succeed at the cost of great sacrifices, or by manœuvres that would entail much loss of time and over-fatigue. It is now that the artillery intervenes. The method by which this is done has been interpreted in many different ways. Formerly, the importance of being the first to open fire was childishly exaggerated. Then, however, a reaction was produced by the risk of exposing artillery prematurely to the enhanced power of the hostile guns. Nowadays, therefore, bearing in mind the perfectly sound principle that preparation rather than the actual opening of fire is of most importance, we may be inclined not to bring our guns into action until the enemy has unmasked his own. But we should be neglecting the most important duty that artillery has to perform if we withheld its support

from the infantry, which could not then accomplish its task in sufficient time. The question must be regarded from a more liberal point of view than that of the technical requirements of the arm.

The first few rounds fired may considerably influence the subsequent course of the fight. So both the French and German drill-books agree in forbidding fire to be opened without the supreme commander's orders, especially on the defensive. In the attack subordinate officers must, of course, exercise their own initiative; but failing orders from headquarters, the commander of the advanced guard has the sole right of bringing the artillery into action.

The employment of the advanced guard batteries at this juncture has to be calculated with great nicety. They have, in fact, two contradictory parts to play: lending a vigorous hand, if necessary, in aid of the infantry, while husbanding their resources so as to bring the advanced guard action to a successful issue, which may take some time.

Moreover, as the German drill-book wisely remarks, artillery plays a preponderant part in the advanced guard fight, because it can co-operate towards the desired end "without calling for the intervention of large bodies of infantry all at once."

German F.A.D. § 343.

There are two reasons why the advanced guard artillery should be widely extended: to deceive the enemy as to its real strength, and to diminish the chances of loss. At the same time, if these batteries come into action on ground that will be occupied eventually by the main body of the artillery, they must restrict their front within reasonable limits, with a view to future deployment, and in order to avoid more mixing up of units than necessary.

In the battles of 1870 there is no clear distinction to be found between the action of the advanced guard artillery and that of the main body. We find the leading batteries opening fire directly they encounter the enemy without waiting for the commander's orders; often, indeed, in opposition to them.

In the verbal orders given to his army corps commanders on the morning of August 30th, 1870, for the advance on Beaumont, the Crown Prince directed "that each division of infantry, after reaching the far edge of the Dieulet Forest, should wait for the columns on either side of it to debouch, and should only provisionally commence the action with its artillery." G.O.A. p. 986.

The 8th division, being the first to reach the edge of the woods, caught the French camp napping. Not wishing to let the opportunity slip, General Schoeler, contrary to the instructions of the army commander, "assumed the responsibility of an immediate attack." G.O.A. p. 993. Very soon the corps commander himself, General von Alvensleben, believing his presence discovered, which was not the case, sanctioned this move, and ordered the batteries of the 8th division's advanced guard to open fire immediately.

The consequence of these first rounds, so hurriedly fired, was to bring on a general engagement.

The 7th division had been working methodically, and had kept to the orders received from headquarters. "But the leading troops were scarcely formed when the sound of the guns from the direction of the 8th division decided General von Schwarzhoff to lend a hand forthwith, taking into account this unlooked-for development." The batteries went into action so precipitately that, failing a proper "manœuvring zone," they found themselves from the very commencement

of the fight in the line of skirmishers, and suffered severely.

G.O.A. p. 1004. When the sound of the guns reached the 23rd (Saxon) division, the leading regiment went off at the double.

Similarly, on hearing the guns firing, the General in command of the 1st Bavarian Corps "at once gave orders to the 2nd division to advance forthwith on Beaumont and engage on the left of the IV. Corps. . . . The two advanced guard batteries, escorted by a regiment of cavalry, went forward at a trot."

G.O.A. p. 1007.

Thus the sound of the guns of the 8th division was actually the signal for the battle, and hastened the arrival of the other three columns on the scene of action. If the 5th column remained behind it was only that its advance was retarded by an unforeseen obstacle in the shape of a boggy stream.

Notwithstanding the exceptional conditions under which the French laboured—tired out, depressed, and completely surprised though they were—they managed to inflict serious loss on the heads of the German columns. Under more favourable circumstances they would have crushed and rolled up in detail these units which debouched one after the other in this fashion.

The German Headquarters had made a mistake in supposing that the columns could "provisionally engage with their artillery"; the action was bound to be decisive.

The same error of judgment was made on the battle-field of August 18th, when General von Moltke advised the 1st Army "not to commit itself altogether, and directed it not to show itself in great strength, confining its action to using its artillery to prepare the subsequent attack."

G.O.A. p. 668.

General von Steinmetz, by engaging with the artillery

of two army corps, and making it open the action with extreme vigour, began the battle on the German right wing, and caused the bulk of the infantry to be brought into play sooner than the German Commander-in-Chief could have wished.

As we have seen in the case of the German columns at Beaumont, the batteries in 1870 were in the habit of marching to the sound of the guns and coming into action in succession, without even taking the trouble of making sure of a safety zone in which to work. Thus the artillery mass was formed by successive reinforcements after more or less time, occasionally hours, had elapsed. In consequence of this the directing staff were quite unable to keep touch with the progress of the concentration, and could not tell how soon its maximum strength would be reached.

It is particularly instructive to study the massing of the artillery at Sedan, not only by reason of the enormous number of batteries brought into line, but because we can clearly trace in it the premeditated idea of combination.

"Even in forming the column," says the official account, "care had been taken to place the batteries so as to admit of their early co-operation, and they debouched on the scene of action with the heads of the leading columns of infantry."

Notwithstanding these precautions, the twelve batteries of the XII. Corps did not complete their deployment for three hours and a half, from 6 a.m. to 9.30 a.m., reckoning from the arrival of the leading battery of the advanced guard. The fourteen batteries of the Guard took three hours and a half, from 9 a.m. to 12.30 p.m.; the XI. Corps took two hours to deploy its fourteen batteries, from 9 to 11 a.m.; and the V. Corps required

only one hour, from 10 to 11, to get its ten batteries into line.

To be precise, the massing of the German artillery on the eastern side of the battlefield, occupied by the XII. and Guard Corps, took over six hours; on the north side, where the XI. and V. Corps were stationed, it only took two hours.

After the war the Germans felt that their success could not justify such practices as these. Artillery even equal to theirs, and much more so if armed with powerful quick-firers like that of to-day, would have crushed these detachments in detail as they arrived one after another on the position. They thereupon devised the schemes, to which we will refer later on, in connection with the measures to be taken for insuring the concentration of the mass.

RANGES AT WHICH FIRE SHOULD BE OPENED. It does not follow that the main body will occupy the same ground as the batteries of the advanced guard, when the advanced guard action gives place to the general engagement. Even when it does so happen the batteries of the main body should avoid placing themselves exactly alongside those of the advanced guard, as the enemy will have got their range already.

However, this is the most usual case, and the one we shall consider in discussing the ranges at which fire should be opened, neglecting the special occasions when the advanced guard batteries have a separate mission altogether, not directly connected with the course of events.

At what range are we to open fire?

In France, where we are perhaps rather too fond of figures, the old drill-book of 1887 used to say that "artillery does not fire at over 2700 yards."

The regulations of to-day are not so categorical. "Artillery avoids firing at over 3300 yards," it lays down, "unless it has a very large and visible target." French F.A.D. § 420.

The German drill-book, with its usual shyness as to giving precise figures, contents itself with saying that the "first position should always be chosen as close to the enemy as circumstances will allow." German F.A.D. § 345. But further back it has taken the precaution of saying that this position varies "in accordance with the intentions of the commander, the tactical situation, the ground, and the weather." Besides this, it pronounces the opinion that "long-range fire at columns on the march is admissible, provided there is no desire to conceal the position from the enemy." *Ibid.* § 312.

This reference to long-range fire, though restricted to a particular case, is interesting to notice, as it represents a new departure in the German drill-book, and reveals a tendency confirmed by other official works.

The German drill-book, in its instructions relative to grand manœuvres, allows that forces of artillery may engage each other at ranges of over 3300 yards; but it adds that, under these circumstances, one side must possess great numerical superiority, or be assisted by a timely intervention of the other arms, before it can hope to get the better of its opponent.

At the German Imperial manœuvres of 1897 fire was opened at 3300, and even 4400 yards. On service the range at which fire has to be opened will be imposed by circumstances and the nature of the ground, besides which it depends on the state of the atmosphere.

In 1870, on the battlefield of August 18th alone, with armament very inferior to that of to-day, the range varied from 1750—at which the Hessian batteries came

into action against the artillery of Cissey's division—to 3300 yards, the distance of the Saxon batteries' first position from the Saint-Privat-Roncourt heights.

Prince Kraft relates that before the 1870 campaign he "had directed the batteries under his orders to avoid opening fire over 2000 paces as far as possible. Soon after," he adds, "we received orders from the G.O.C. the artillery of the army not to fire beyond 1800 paces. I had every intention of adhering to this on nearing the scene of action on August 18th." However, the Prussian batteries placed at the foot of the Saint-Privat glacis were obliged by the force of circumstances to come into action at 2200, 2800, and even 3200 paces. "The situation," says the former commander of the Guard artillery, "was too strong for our intentions."

PRINCE KRAFT, 13th Letter.

At Sedan the batteries of the 4th Cavalry Division, from the heights of Montimont, opened fire about ten o'clock at 4400 yards on the French artillery of the 7th Corps, deployed on the plateau of Floing, across the Iges peninsula.

Though the range was so long, "these batteries succeeded in diverting some of the enemy's fire in an easterly direction; but as their shells were going rather too near the Prussian troops at Floing to be pleasant, at midday the Crown Prince ordered them to cease firing."

G.O.A. p. 1163.

At Sedan, again, two batteries established to the north of Bellevue Park, "in spite of the long range, by the Crown Prince's orders brought an enfilading and reverse fire to bear upon the French field artillery between Floing and Illy—at over 4400 yards' range."

G.O.A. p. 1141.

The effect of the quick-firer seems to be to increase the range at which fire is opened. On the one hand,

choice of the earlier positions is much restricted by the necessity for occupying them unseen; on the other hand, neither side will be very keen to start at a position within effective range, which nowadays means *annihilation* range.

"With the weapons that our artillery possessed in 1870," wrote Prince Kraft in 1884, "efforts were made to keep ranges down to 2700 yards, because at anything over this the fight became a mere desultory bombardment. But now, when the terrible shrapnel carries to 3800 yards, the artillery duel must begin at from two to three miles." PRINCE KRAFT, 10th Letter.

The smallest detachment of infantry, when well concealed, can, with its present rifle, stop any artillery advancing, and oblige it to halt short of the position it might otherwise have meant to occupy.

The Greco-Turkish war already revealed a tendency to long-range fire at the commencement.

This tendency has now been confirmed in South Africa. We find the British artillery opening fire at 3800 (Magersfontein), and even at 4400 yards, as at Modder River and Elandslaagte, from the Boer positions; while at Glencoe the Boer artillery dropped shells at 5500 yards into the British camp, which it took by surprise.

These ranges are certainly very long, and would probably only occur abnormally in a contest between forces of European artillery of considerable strength, efficiency, and manœuvring power.

Nevertheless, these instances may be very instructive, for it is fairly certain that the ranges at which fire is opened will be greater than is generally realised. So General Rohne thinks. "I believe," he avers, "that firing will begin at far greater ranges."

In any case, if it is desired to effect a surprise, it is

essential to get fairly close; otherwise, after making a noise and disclosing our presence, it will be necessary to change position to get within effective range.

This is just what the advanced guard battery of the 18th Prussian Division did on August 18th. "At 11.45 it took up a position on the heights to the east of Verneville, and immediately opened fire both on the French camp and on one or two battalions which appeared to be in the act of advancing on Verneville. However, it soon became apparent that the range was too long. . . . The first rounds which the German guns
G.O.A. p. 674. fired gave the alarm to the whole of the enemy's line."

The only means of contending with an adversary armed with guns of longer range is to go in to the range that suits one's own weapons, just as the Germans in 1870 did with their infantry, who were armed with a rifle considerably inferior to our Chassepot. On August 18th the 3rd Brigade of the Guard had pushed on from the La Cusse wood towards Amanvillers. "In this position its advanced line was shot at from right and left; but then the foremost French troops in their turn were within reach of the needle guns, so that a vigorous
G.O.A. p. 813. reply could be made to the steady fire of the defenders."

Against quick-firing guns this advance by batteries into the hostile artillery's radius of action will have to be carried out under cover, and will demand manœuvring skill of a high order.

CONCENTRATION OF THE MAIN BODY OF ARTILLERY.

The main body of artillery is part of the "force at the commander's disposal," which, as the drill-book says, "the advanced guard enables him to assemble."

This great artillery concentration must be carried out as rapidly as possible; the artillery mass must, in fact,

come into action before the main body of the infantry, and prepare the way for it.

If the army corps are advancing in columns of route, and have but few roads at their disposal, the concentration will take some time. (*E.g.*, the massing at Sedan.)

If the corps advance in close order across country, the concentration will be effected in the shortest time possible, but this will rarely happen except in the case of a premeditated engagement with an enemy in position, as on August 18th.

We have seen how the Germans are almost inclined to suppress the advanced guard artillery, to obviate the disadvantages of fire being prematurely opened contrary to the commander's wishes. But as, on the other hand, the advanced guard must have some artillery with it to keep going, the German drill-book, as we know, leaves it to the commander of the force to determine the amount of artillery to be employed at first. This must evidently be borrowed from the batteries of the main body. However, at the Imperial Manœuvres of 1899 the Germans did not seem to pay much attention to the special action of the artillery preceding the arrival of the main force.

In order to deploy their forces simultaneously, they increased the number of columns, whilst each division pushed forward in the section told off to it, and brought all its artillery rapidly into action. The abolition of corps artillery and its distribution amongst the divisions makes it obviously easier to carry out such movements, but this procedure presupposes the existence of a large number of roads converging on to the enemy's position.

At the same '99 manœuvres a tendency was remarked towards bringing the whole force of artillery into line before any troops were seriously engaged. Its

deployment was covered by nothing but a few infantry detachments, whose business it was to provide for its immediate security.

German F.A.D. § 307.

The German drill-book's final advice, especially as regards large units, is that "batteries should be assembled in a preparatory position out of sight, so as to facilitate a simultaneous opening of fire, as well as an orderly and well-regulated occupation of position." From the foregoing it would appear that these instructions apply rather to a momentary halt on the part of the larger artillery units than to a combined movement connected with the massing of the whole force.

On the whole, therefore, the Germans in this way avoid the danger of bringing batteries one after another on to the position, which was a risk they ran in all their great concentrations in 1870. By well-timed deployment they add a wonderful effect of suddenness to the massing of their guns, but in return the security of the batteries during the process is very precarious; nor do they now, any more than in 1870, provide their artillery with the necessary manœuvring zone.

Besides this, by deploying in such a hurry, before any serious part has been taken by the artillery in the advanced guard fight, they run the risk of developing the whole of their force against a mere advanced post, without sufficient verification of what may be only a screen or advanced line.

This brings us back to the idea already suggested—the massing of the main force of artillery during the advanced guard action. This operation will take up more or less time, according to the formation in which the army corps are marching, and may require several hours.

The advanced guard artillery will be maintaining the

struggle all this time with its own resources, or, if absolutely necessary, it may borrow reinforcements from the batteries of the main body. The defensive power of modern weapons will enable the advanced guard to hold its own for the necessary time, and to insure the manœuvring zone for the rest of the force.

Concentration need not necessarily mean that the whole mass are collected in assembly formation, but it implies all the steps taken to insure the simultaneous opening of fire by the massed guns. Some batteries may very possibly wheel into line direct from columns of route, without passing through the intermediate rendezvous formation.

If it should be necessary, when approaching the scene of action, to cross a space exposed to hostile fire, "advantage will be taken of darkness and the batteries brought up during the night ready to open fire at daybreak."

Artillery in the defence will play a similar part during the preliminary phase to that of the attack, using a few batteries to make the enemy show his hand, while the mass is held ready for an immediate effort in any direction when the right moment arrives.

CHAPTER III.

ARTILLERY IN THE PREPARATORY PHASE.

"The artillery comes into action as soon as possible, devoting itself to the contest forthwith, and vigorously replies to the enemy's artillery, which it endeavours to silence as quickly as possible.

"The infantry proceeds to gain ground step by step, advancing from one tactical point to the next towards its allotted objective. It is assisted in this by the artillery, which prepares each of the subsidiary attacks." (*French Regulations for Field Service*, § 129.)

THAT phase of the fight which the drill-book calls "preparatory" has also been termed the "process of attrition," which exactly describes the object in view during this phase, that is, the wearing down of the enemy's moral and material resources, so as to render possible the final effort that decides the day.

The attrition phase is made up of a number of successive episodes, each of which may be a more or less complete prototype of the phases of the battle, but on a smaller scale.

Success will then alternate with failure, and attack will in turn give place to defence. For as there can be no question of a purely passive defence for either side, however situated, each will attempt offensive action, more or less vigorously, and with more or less success. In short, an action that began offensively may end on the defensive, and *vice versâ*, according to the trend of events.

For this reason it hardly seems sound to distinguish between the action of artillery in the defence and in the

attack, which is the procedure usually adopted. Both situations, as a matter of fact, follow each other and overlap in the course of the same engagement. The tactical employment of artillery is governed by the same principles, whether acting on the defensive or offensive. Any difference there may be arises not so much from the actual situation itself, as from the necessity for perpetual combination by all arms in all sorts of circumstances. This is why it appears better to take this combination of effort as our basis in studying the part that artillery should play.

To avoid the encumbrance of conventional phraseology, it has been thought advantageous to show by numerous examples the significance of the expression "combination of all arms."

This much we may now state as a fact: "there is no chance of turning good infantry out of a well-defended position by means of artillery fire alone." On the other hand, "under normal conditions artillery can never be turned out of a position by infantry, against its will." GEN. DRESKY. PRINCE KRAFT, 7th Letter. 11th Letter.

This virtually means that neither arm, if relying only on its own resources, has sufficient power to obtain a decisive result; it paralyses the enemy and is itself paralysed in return.

This mutual paralysis of artillery and infantry occurs in almost every fight in the South African War. It is only by manœuvring and by the co-operation of the two arms that decisive results will be obtained.

THE MAIN FORCE OF ARTILLERY ENGAGES THAT OF THE ENEMY. We have seen how the artillery is massed under cover of the advanced guard, which assures it the manœuvring and security zone, and allows the force to be got ready for the work in hand.

We have also seen how the main force of artillery may come into action with all its batteries at once, or may, to some extent, follow the principle of husbanding its resources. But whichever plan is adopted, there is one essential condition that makes for success, and that is the element of simultaneousness and surprise.

French F.S. § 135, and German F.A.D. § 134.

Batteries that are to come into action behind cover can take up their positions beforehand, whilst those that have to expose themselves more or less to the enemy's view will make all their preparations in advance, but will not move into position until the actual time of opening fire.

If it is a case of the massed artillery being deployed on a front of several miles, the word "simultaneous" is not, of course, to be taken quite literally. Simultaneousness cannot be secured except in the smaller tactical units, but the object is to insure that fire is opened over the whole front vigorously and rapidly enough to disconcert the enemy.

The choice of position and the time of opening fire are exclusively reserved for the supreme commander to decide.

German F.A.D. § 230.

The first target which the massed artillery will have to engage is the mass of the enemy's artillery, for these can reach each other at long ranges, and as long as one remains intact and free to act in any direction, it will neutralise the efforts of its adversary. This is the special duty assigned to the massed guns by the official instructions.

"From the commencement of the action," says the French drill-book, "the artillery must strain every nerve and use every means to establish a superiority of fire over its opponent"; and the German Manual declares "that in the early part of the fight the enemy's artillery must be attacked as a rule."

The advanced guard batteries participate, of course, in the fight, unless they have a special objective told off to them to engage.

Such exaggerated ideas have been conceived of this contest, the artillery duel, to give it the title usually applied, that it has come to be looked upon as if really a formal encounter between the artillery of either side, to be settled in the presence of the other arms, but without any assistance from them.

To appreciate the cause and effect of such mistaken views, it is as well to see how they first arose.

There was no such thing as the artillery duel in the days of smooth-bores, everyone was agreed on that point. "The business of artillery" says Jomini, "is to overwhelm the enemy's troops and not to reply to his batteries."

In the writings of Frederick the Great, Guibert, Du Puget, and Gassendi we find this point emphasised throughout. They all endeavour to counteract the inveterate tendency of the gunners who, as Napoleon used to say, "from a natural but mistaken sense of conservatism," and, as Frederick remarks, "to satisfy the neighbouring troops," would persist in maintaining a desultory contest with the hostile artillery. LISKENNE, V.

In our time the artillery duel is carried out at long ranges, while the troops are still outside the zone of rifle fire, or while the hostile infantry is concealed by the ground; directly the latter becomes at all threatening the guns must turn on to it at once.

The German drill-book provides for this up to a certain point: "If the artillery duel be sufficiently advanced," it says, "it is admissible to fire at any infantry that can be caught in close formation." German F.A.D. § 312.

To-day, just as in the past, the vital thing is to prevent the advance of the infantry. This was done by the French artillery at Valmy, which ceased firing at the Prussian guns, and, disregarding them entirely, turned on to the infantry, when it endeavoured to advance.

CHUQUET, Vol. II. p. 208.

Similarly, the six Saxon batteries, which after the capture of Sainte-Marie-aux-Chênes, took up a position to the north of the village, along the Auboué road. Here, these six batteries, while still engaging the French artillery between Saint-Privat and Roncourt, concentrated their fire specially to the west of the latter village, on the masses of infantry which the enemy was pushing forward, but which were compelled to retire after every renewed attempt.

G.O.A. p. 730.

Formerly, to be sure, when the range of the smooth-bore was so feeble, the infantry attack became threatening while still scarcely within range of the guns; so that except occasionally, as at Valmy, there could be no excuse for an artillery duel.

The latter seems to owe its existence to the increase in ranges, but it must still conform to the principles observed in the days of smooth-bores.

Our instructions on the employment of artillery in the fight of 1887 seemed to consider the artillery duel a distinct phase of the battle, which appeared to warrant its advocates in declaring that the practice was officially recognised.

Current regulations, both French and German, have discouraged this tendency, and do not treat it as a specially defined part of the engagement.

Moreover, as General Sir Redvers Buller wisely remarks, "artillery need not always commence an action by firing at the hostile artillery; in some cases

there may be more to be gained by opening on other objectives." [1]

We shall see, for instance, as we go on, that the first act of "direct co-operation" by neighbouring troops is often begun by artillery. In such a case the greater part of the guns will be required to open fire on whatever target the other troops are already engaging.

On August 18th the 1st division of the Prussian Guard had come to a standstill in front of Saint-Marie-aux-Chênes, and a "powerful development of artillery was necessary against this village." The batteries "of the Guard were engaged with other targets, which they could not leave, and only two were available. So General von Pape, commanding the 1st division of the Guard, took the batteries of the 24th Saxon division, which was just arriving west of Sainte-Marie." G.O.A. p. 718.

"At the same time the Saxon Corps artillery in its turn debouched on to the field of battle, and formed its seven batteries along the road leading from Batilly to Auboué." Thus the bulk of the Saxon artillery, eleven batteries in all, found itself in action at the commencement of the fight against infantry and a village, instead of opposing the enemy's artillery. G.O.A. p. 783.

Even admitting that the appearance of the main force of artillery on the scene of action may provoke a regular artillery battle, the co-operation of the other arms entirely deprives it of the character of a duel. Even if the whole of the artillery is simultaneously engaged in this contest, it is still essential that it should keep an eye on the ground, so as to be ready to turn on to any target which may appear.

It is true that at the beginning of the preparatory

[1] "A Criticism of the English Manœuvres in 1899." (*Revue du Cercle Militaire*, October 20th, 1899.)

phase, artillery will generally direct its fire on the enemy's guns, but there can be no artillery duel, in the narrower sense of the word. As the situation develops, so fire is turned on to various other targets, and the artillery fight is merged in the succeeding incidents of the preparatory phase.

As we have noticed in discussing fire effect, the use of shield-protected quick-firers will probably result in prolonging the mutual process of attrition to greater length than formerly.

Artillery may be more or less paralysed, or possibly silenced for some considerable time, but it will rarely happen that more than one or two units are completely wiped out. In reality it is more probable that the artillery fight will last throughout the day.

THE ARTILLERY MASS FIRST PROTECTS THE INFANTRY'S FRONT. The artillery is massed and brought into action by the help of the advanced guard infantry, which provides it with the necessary zone in which to manœuvre with safety. In return the artillery, once it gets to work, forms a screen, behind which the infantry main body can concentrate and manœuvre.

So from the very first we find that union of the two arms confirmed, which was remarked in the preliminary stage, and so close are the ties between them that one cannot help the other without requiring similar assistance itself before long.

On August 18th, General von Pape, commanding the 1st division of the Guard Corps, had arrived about 1 p.m. at the southern end of Habonville, with the head of his advanced guard. After a rapid glance at the situation, he determined to bring his four batteries into action, and march his division under their protection to Sainte-Marie." Shortly after the corps artillery

G.O.A. p. 711.

came up to prolong the line of the 1st division's batteries.

"*Behind the long screen formed by its artillery* the Guard was enabled to collect a division at Sainte-Marie and a brigade of infantry at Saint-Ail." G.O.A. p. 738.

DISTRIBUTION OF SUCCESSIVE TASKS AMONG THE MASSED BATTERIES.

Let us suppose, as a case in point, that the massed artillery on either side mutually selects the opponent's guns as its objective. Sooner or later one of them will establish a decided superiority over the other, and the preparatory phase, with all its incidents, will be gradually developed. But the artillery's task is only now beginning, for, in the words of the Field Service Regulations, "The whole object of this (the artillery) duel is to enable the artillery subsequently to devote all available resources to its principal task, which is the material and moral support of the infantry during each succeeding stage of the fight." French F.S.R. p. 135.

The preparation or attrition phase consists of a series of local contests, aiming at the attack or defence of tactical points.

The employment of such points, as General Maillard has so admirably demonstrated, "localises the fighting, and enables more men to be spared for the offensive. As few troops as possible should be told off to these localities and the greater portion retained for manœuvring"—that is, counter-attack.

The artillery has a hand in these local encounters, thereby showing itself the preparatory arm *par excellence*. It is the preparatory arm precisely because it economises infantry.

In this way the artillery mass is broken up into several groups, each with a separate task allotted to it,

but capable of being re-combined into larger bodies to suit the requirements of the situation.

In apportioning these tasks the batteries belonging to particular units remain attached to them as far as possible, and the remainder will be detached by the artillery commanders in accordance with instructions from headquarters.

Once a group of batteries has been given a definite mission it must never lose sight of it. Nevertheless, it may happen that such batteries can only accomplish their task by temporarily turning their fire on to quite a different target, to all appearances.

Suppose, for instance, that certain batteries have been ordered to fire at infantry or at some locality, but are themselves under hostile artillery fire, and, being unsupported by other batteries, are in danger of being silenced. The only means by which they can carry out their orders is to rid themselves first of all of this artillery. To this end they will relinquish their primary objective for a few minutes, at any rate, with some of their guns, which they will turn on to the enemy's artillery. If unable to silence it altogether, they must manage to render its fire less galling, and will then turn back to their old target.

The power of rapid destruction possessed by the quick-firer allows of such partial and momentary change of targets, which was formerly impossible without permanently abandoning the primary objective. In those days it took hours of firing to obtain appreciable results.

During the lulls, which are characteristic of the quick-firers' employment, it is strictly incumbent on every brigade division or battery commander, without prejudice to his own special task, to come to the assistance of his neighbour, or even to take his place.

In order to fulfil their different tasks batteries will often have to change their positions. It will sometimes happen that positions are too cramped, or the batteries too numerous, especially in the attack, where the front becomes narrower in proportion to the progress made. In such cases it will be necessary to hold in reserve those batteries for which no room can be found.

Sometimes if the ground favours it, batteries may be placed in tiers, one above the other, but this is difficult to carry out in practice without inconvenience or danger to the batteries in front, and it is very rare to find this method employed.

It often happened in 1870 that the Germans could not find room for all their batteries.

During the battle of Sedan there were always about ten Bavarian batteries standing idle to the south-east of Bazeilles after that village was captured.

The spare batteries must be assembled in such positions as will best facilitate their rapid advance to any threatened point.

Similarly, when the fire of a battery in action is masked by the advance of its own infantry, and the battery is for some reason prevented from pushing forward itself, *it must remain in position, and not retire.*

It should always be borne in mind that the enemy may resume the offensive, and, should this occur, the guns would have to be brought back to the position they had abandoned. This is what happened to the Bavarian artillery before Bazeilles.

After the capture of the village a line of ten batteries (six Bavarian and four Prussian) had been established on the high ground to the north. When the Bavarians

entered Balan, "the Bavarian artillery, which had been operating to the north of Bazeilles, finding nothing more to do after the retreat of the French to the Givonne valley, withdrew three of its batteries to a waiting position."

G.O.A. p. 1205.

About two hours later came General de Wimpffen's counter-attack. Balan fell once more entirely into our hands, and the Bavarians retreated as far as Bazeilles. "The Bavarian artillery at once proceeds to prepare the way for the recapture of Balan." In less euphemistic terms, it has to send back its batteries to the position which had been so thoughtlessly denuded of their guns.

G.O.A. p. 1209.

Batteries to Engage Artillery.—It is inadmissible to imagine that the artillery of one side should have been able to annihilate that of the other. If so the result of the battle is a foregone conclusion.

One side will merely have established a superiority of fire over the other.

The side that has had the worst of it will still be able to keep up a desultory fire of diminished intensity, but never a negligeable quantity with quick-firing guns. It may withdraw some batteries, and can bring up the artillery of second line corps, so as to organise a fresh concentration and manœuvre to resume the struggle.

On August 18th, the French artillery on the heights of Saint-Privat and the plateau of Point-du-Jour, furnished two instances worth remembering of how batteries should be employed, when handicapped by hopeless inferiority. Its procedure at each end of the battlefield was the same. Without persisting in the unequal struggle, in which it would have been annihilated to no purpose, it ceased firing, and kept out of

sight ready to reopen fire vigorously at the opportune moment, and so took the enemy quite by surprise when he had already discounted his success.

The laconic account of the German Staff is most instructive.

"At Saint-Privat, in face of the formidable deployment of 180 German guns,[1] the French artillery, which was inferior in numbers and short of ammunition, had almost entirely ceased firing, reserving itself for the moment when the German infantry should commence its attack."

On the plateau of Point-du-Jour before the deployed batteries of the 1st German Army, "The French artillery, after temporarily giving up the contest with the superior force of German guns, only waited for a favourable opportunity to reopen fire." The opportunity presented itself when the huge masses of the Germans crossed the La Mance ravine, and ran their heads against "a resistance which was as vigorous as it was unexpected." It was touch and go, as is well known, that the movement did not end in disaster. G.O.A. p. 773.

It really seems as if the compiler of the German drill-book had these instances in his mind's eye, from the great resemblance of the official account to the words of the drill-book. "If before the commencement of the infantry attack," says the latter, "the hostile artillery develops such superiority that nothing is to be hoped for from a continuance of the artillery duel, the batteries may, by the commander's order, seek shelter from the effects of the enemy's fire." German F.A.D. § 353.

If very weak in artillery a commander on the defensive may start by using it as indicated in the

[1] Twelve Saxon batteries, 12 batteries of the Guard, and 6 of the IX. Corps.

foregoing examples, where the artillery of one side has had the worst of it.

The Boer artillery acted thus at the battle of Magersfontein. For hours it made no reply to the British artillery, and it was not till about half-past five in the evening that it suddenly opened fire. It did not then fire on the enemy's guns, but on the ammunition wagons, which were stationed in a fold of the ground, out of reach of rifle fire.

FROCARD and PAINVIN, p. 345.

The side that has got the upper hand must detail a certain number of batteries for the special duty of maintaining the contest with the enemy's artillery. These will adapt their action to that of the enemy, and their part may thus become that of batteries "in observation." Whatever happens, their duties must be performed with the greatest care and without intermission, and they must make it their business to prevent the enemy, once he has been silenced, from reopening fire, whether his position is in the open or behind cover. Whatever they can see they must paralyse, and must be prepared to turn on to any fresh batteries that may subsequently try to establish themselves.

The batteries on which this special duty devolves are termed "counter-batteries"; their task corresponds in the later stages to that of the "observation batteries" before the duel.

The greater the facilities that the enemy has for getting cover, the greater watchfulness must be exercised by these counter-batteries; and the more formidable the guns of the enemy, the more effective protection must they insure.

Therefore the functions of counter-batteries assume capital importance with the adoption of the quick-firing gun, which enables such great effect to be obtained from

a few guns skilfully concealed. The only way to make sure of their duties being adequately performed is to increase the number of counter-batteries.

Counter-batteries may be stationed in the position from which fire was first opened, or further forward, if the mass or part of the massed batteries has had to get to close quarters to establish complete superiority.

They may occupy a position behind cover or in the open. Behind cover they will be much safer and proportionately more effective in action. On the other hand, the necessity for keeping a careful eye on the ground will make it necessary for some counter-batteries to be in the open.

As the action develops the counter-batteries may be required to change their position. These movements will invariably be executed by *échelons*, so that the enemy's artillery may be continuously "countered," and the ground unceasingly watched by the batteries remaining in position.

Batteries to Engage Infantry.—It will be remembered, with regard to action behind cover, that, to obtain the fullest fire effect against infantry, guns must be placed on the military crest. I say the military, and not the topographical crest, as batteries occupying the latter would be less well situated when it came to sweeping the forward slopes and hollows, besides which they would be showing up on the skyline.

It follows therefore that, as a rule, batteries that have come into action behind the crest against artillery, will have to advance beyond it when they wish to turn on to infantry.

These changes of position will vary widely in extent, and may be performed either with the aid of the teams,

or by any of the methods proper to the occupation of covered positions, at the discretion of the battery commander.

To bring effective fire to bear on infantry, artillery must never hesitate to push resolutely forward, even after suffering severe losses, and especially when the situation is critical.

"On August 18th, after the departure of the five batteries from the position occupied by the artillery of the IX. German corps, there remained there at three o'clock only three batteries of those which had formed the right wing. None the less Captain von Eynatten, on whom by this time the command had devolved, ordered a change of front to the left on the centre battery, and advanced about 200 yards the more effectively to shell the columns of French infantry, which had established
G.O.A. p. 695. themselves in the hollows and folds of the hillside."

Apart from firing at infantry targets, the batteries must watch for any movements that the hostile infantry may make. They will not tie themselves down to their emplacements, but, even more than the counter-batteries, they must push forward in obedience to the march of events. A certain number of batteries, as we shall see, must move immediately in support of the infantry advance.

Batteries Accompanying Infantry.—The support of the infantry is described in our drill-book as the principal task of artillery, to which all its available resources must be devoted. Artillery can only support infantry by accompanying it.

The word "accompany" is to be understood in the widest sense of the term. Occasionally, taking advantage of its long range, artillery will support the infantry from a distance, in the earlier phases of the fight; at

other times it will be literally shoulder to shoulder with it, right up in the firing line itself.

No precise rules can be laid down. The essential thing is that the co-operation of the artillery should be effective and uninterrupted; that it should be, in von der Golz's words, "the infantry's inseparable companion."

Whenever attempts have been made to formulate rules on the subject, they have had to be abandoned almost immediately. At the German Imperial Manœuvres of 1897 the Bavarians were criticised for not following the infantry closely enough. True, the ground was in a soaking condition, and the infantry advanced at an impossible pace. Only the year before the Emperor had found fault with the artillery for evincing the opposite tendency, in changing their position too frequently, and hanging on to the infantry's heels by way of supporting them. *Revue militaire de l'étranger*, Feb. 1898.

Small bodies of artillery may now and then for a particular purpose advance to within such close range of the enemy as would appear incredible, if we did not know of such cases having actually happened on service.

After the Bavarians had got into Bazeilles, they were stopped at the junction of the main street and the Douzy road by a building which defied all attempts at capture. "At 7.45 two 4-pounders of the 3rd battery of the 1st Regiment came up to within 70 paces of the building, and began to shell it; this drove out the defenders and allowed the Bavarian infantry to occupy it."

Meanwhile, in the northern part of the village, the Villa Beurmann still remained impregnable. "It was thereupon decided to have recourse to the guns to overcome this resistance, and the two above-mentioned

were man-handled into the main street by a lateral communication, which the enemy had failed to guard. In spite of a hail of bullets, First Lieut. Fricker managed to launch a dozen shells at the villa, but then, nearly all his gunners being disabled, he was obliged to get help from some infantrymen to run his guns back behind the street corner."

G.O.A. p. 1094.

On such an occasion, had the guns been shield-protected quick-firers, instead of 4-pounders, they would have had a very different chance of accomplishing the end in view.

Sometimes, from the unfavourable nature of the ground, artillery may have to pick its way outside the space allotted to the unit with which it is advancing. It will then make use of its long range to operate on this space, though actually stationed outside it. Sometimes artillery may be able to support the infantry effectively from a position far in rear. But usually it will have to push forward.

The Saxon artillery in position to the west of Sainte-Marie-aux-Chênes did this on August 18th, when its fire was masked by the infantry attack in the direction of Roncourt. "Directly the village was captured the corps artillery batteries crossed the ravine in their front, and the 3rd brigade division reached a new position to the north of Sainte-Marie. To do this it did not hesitate to come within range of the enemy's rifle fire."

G.O.A. p. 730.

At Beaumont, when the Prussian battalions were advancing on the French camp, the guns of the IV. Corps found their fire masked in consequence. . . . The fourteen batteries of the corps, pushing forward by *échelons*, followed the advance of the infantry.

G.O.A. p. 1002.

At Sedan, if Fraboulet's brigade, which was sent

forward by General Ducrot on the left bank of the Givonne to secure the Daigny bridge, ever seriously threatened the Saxon right, before reinforcements came up, this result was entirely due to the presence of the batteries of Lartigue's division.

The German account quotes their presence as a proof of the gravity of the situation. "Guns and machine-guns," it says, "were already coming into action on the left of the Zouaves." G.O.A. p. 115.

This is the spirit of the drill-books in saying that artillery "must never fear to face even the heaviest rifle fire."

The batteries to accompany the larger infantry units will usually be those naturally belonging to them. But circumstances may render it necessary to dovetail into the firing line batteries belonging to divisions and army corps whose radius of action is possibly quite different. A glance at the plans showing the positions of the German batteries in the actions of 1870 will easily convince one of this fact. In such cases the infantry will be accompanied by those batteries which are most suitably placed for the purpose.

During the advance, batteries may not have to remain in the same position for any length of time. It will be a case of firing a few rounds, and not establishing themselves permanently, under which circumstances the limbers must be kept handy, somewhere under cover, ready for an immediate advance to another position.

This advance must itself, indeed, be secured by the alternate fire and mutual support of the two arms. We find a characteristic example of it in the action of the IX. German Corps on August 18th.

This action, as a matter of fact, resolved itself into a series of efforts to disengage the artillery, which was

so terribly compromised at the outset; as the official account expresses it, "to give it breathing space."

The reason for these batteries being thus compromised was that they were unprotected when coming into action by the rifles of their infantry. The fact that they were able, after a partial and temporary retirement, to re-occupy the position in force, was due to the breathing space afforded them by the infantry, which had occupied the tactical points in their front, namely, the spur south-west of Amanvillers and the Champenois farm. This should have been done at the start.

The subsequent advance of the 49th Hessian brigade and the 3rd brigade of the Prussian Guard against the heights north of Amanvillers succeeded in providing the safety zone for the artillery, though at the cost of great sacrifices.

The German attack was a failure, and the infantry, after severe punishment, remained pinned to the ground, but was in turn saved from ruin by the shells that the artillery sent into Amanvillers. The infantry were thus saved by the powerful artillery fire which their own advance had rendered possible, but, besides this, a further advantage was gained for the batteries.

By destroying Amanvillers, which might have furnished the *point d'appui* for a French counter-attack, the artillery provided against a recurrence of the movement that had nearly destroyed it at the commencement of the day.

Thus, in protecting infantry by its fire, artillery finds its own salvation and *vice versâ*.

The bloody repulse of the Prussian Guard before Saint-Privat affords an admirable example of the extreme support given to infantry by the advance of artillery.

The remnants of the 4th brigade and the greater part of the 1st division were pinned to the ground. The problem was to save them from being wiped out altogether, and so recourse was had to the artillery. This was about 6.30 p.m.

By remaining where they were the Prussian batteries would have been unable to give the infantry any real assistance, as the opposing lines were too near each other; besides which a forward movement was bound to produce great moral effect. "Twelve batteries of the Guard were in position between Habonville and Sainte-Marie. . . . The whole of this line of guns then pushed forward in succession." G.O.A. p. 835.

This advance of the artillery of the Guard to within less than 1100 yards of the French position was a wonderful performance, though had the 6th (French) Corps possessed any artillery itself, it could not possibly have been successful.

Once the movement was completed, about seven o'clock, part of the batteries directly supported the infantry engaged by placing themselves 500 yards in rear of its centre; the remainder formed line to the right to resist the offensive movement of Cissey's division north of Amanvillers. This manœuvre is specially worthy of notice, as it instances one of the most essential parts that artillery has to play in action—the warding off of counter-attacks.

No infantry attack can succeed or be repulsed without the assistance of artillery.

The battle of Sedan is particularly instructive in this respect, from the formidable amount of batteries deployed, to which the French could oppose only sadly disproportionate numbers. Every time the French resumed the offensive with insufficient artillery to support their

infantry they were broken by the crushing fire of the German batteries, after having more or less overcome the enemy's infantry.[1]

The Germans, on the other hand, have to thank their guns for defeating the local counter-attacks of the French, and owe it to them that their infantry was able to resume the offensive and recapture the lost ground. One has only to recall the two attempts made by the French, one against Balan and Bazeilles, and the other from the Givonne valley against the Saxons.

Infantry, even if victorious, can never debouch from localities under hostile artillery fire unless supported by its own guns. This happened to the 13th Prussian brigade in the pursuit from Beaumont to Mouzon. On arriving at the northern edge of the Givodeau wood it found itself confronted with the French troops placed on the heights of Villemontry, and supported by artillery. "Their first attempts to get clear were repulsed with great loss . . . because the thick undergrowth prevented any systematic combination for attack, and did not permit of adequate preparation by artillery." The German troops were unable to debouch till the defenders of Villemontry, taken in flank by the capture of Mont Brune, had been forced to retire.

G.O.A. p. 1023.

Conversely, it is by the offensive action of infantry, sacrificed itself if need be, that artillery may be disengaged from situations of grave danger.

When the Germans saw the batteries of their IX. Corps absolutely overpowered they felt "that there could be no question of protecting them efficiently otherwise than

[1] These movements, however, must have been arrested by the German reserves, even if they had succeeded in breaking through the troops in first line.

by a serious counter-attack," so a battalion of infantry was sent forward. It was cut to pieces, but its efforts succeeded in extricating the batteries that were most imperilled.

Not only are forward movements assured by the mutual support of the two arms, but possession of the tactical points successively occupied by infantry is confirmed only by the presence of artillery on the spot.

We have noticed how Prince Kraft pushed forward the artillery of the Guard after the occupation of Saint-Ail. It was this movement that went so far towards preserving Saint-Marie, "enabling them by means of oblique fire to drive back the French troops advancing on the village."

At Sedan, possession of Moncelle and Bazeilles was not assured till the Germans "had placed sixty guns on the heights of the Givonne." The course of events, indeed, proved that these batteries alone enabled the French counter-attack from the direction of Balan to be successfully resisted.

In the same engagement also the eleven Saxon batteries and corps artillery of the Guard crossed the Givonne to establish themselves on the heights of the right bank as soon as the infantry there had got a firm footing. It will be remembered that it was the Saxon artillery which brought the French counter-attack to a dead stop on the Liège road.

EXAMPLES OF SOME SPECIAL DUTIES OF ARTILLERY.

As Fire draws Fire in Reply, Artillery is brought into Action to Relieve Troops already Engaged.—If batteries thus called upon find it necessary to attack the hostile artillery, this attack is only a means to an end. It cannot, therefore, be taken as proving the existence of the artillery duel,

which used to be considered the indispensable prologue of every engagement.

When the IX. German Corps was so unfortunately engaged at the battle of Gravelotte, "General von Goeben, in command of the VIII. Corps on its right, directed the commander of the 15th division to open fire with his divisional batteries, in order to assist it indirectly. On its left, the arrival in succession of the Hessian artillery at Habonville and that of the Guard at Saint-Ail diverted the fire of Cissey's batteries and that of the 6th French
G.O.A. p. 688. Corps artillery."

At Beaumont, General von Alvensleben, commanding the 6th Corps, "specially asked the neighbouring corps to bring their artillery into action so as to assist him in
G.O.A. p. 1005. his attack."

At Beaumont again, later in the day, seven Saxon batteries took up a position south of the wood of Givodeau. "Notwithstanding the long range," says the official account, they operated partly against the enemy's troops and guns on the right bank and partly against the artillery posted at Villemontry." It is not claimed that their fire was very effective, but, adds the official account, "these batteries, by thus diverting the fire of some of the French guns, greatly relieved the
G.O.A. p. 1025. pressure on the German infantry occupying the wood of Givodeau."

The last example also shows that long-range artillery fire is sometimes justifiable, even if its fire effect is very small.

EMPLOYMENT OF THE ARTILLERY MASS TO COVER A FLANK MOVEMENT.—On August 30th the French batteries established on the right bank of the Meuse were considerably harassing the right flank of the German troops as they were advancing from Beaumont towards

Mouzon. To cover this movement the Germans merely brought into action the seven Saxon batteries that we have just mentioned, instead of using the whole force of Saxon artillery, most of which remained idle.

Sedan, on the contrary, affords a classic example of the employment of the mass to cover a flank march.[1] There the Prince of Wurtemburg, commanding the Prussian Guard, gave orders "for the main body of his troops to advance by the Givonne, *as soon as the flank movement had been sufficiently prepared by the artillery*. . . . The artillery commander, Major-General Prince Kraft von Hohenlohe, was thereupon asked to deploy every battery belonging to the Army Corps." G.O.A. p. 1132.

EMPLOYMENT OF THE ARTILLERY MASS TO FILL a GAP.—"The action of Vionville," writes General Dresky in a letter already quoted, "has convinced me that the only way to bar a space of open ground with any chance of success is to occupy it with a line of guns which nothing can break through from the front." PRINCE KRAFT, 4th Letter.

At Sedan, both divisions of the 4th Prussian Corps were sent to the right bank of the Meuse, one engaging in support of the Bavarian, less three battalions left on the Meuse, and the other forming the general reserve.

"The corps artillery had been collected in a witing position west of Aillicourt, on the left bank, with the idea of opposing in case of need any attempts made to break out from Sedan by the left bank." So this force of artillery was evidently destined to close the gap existing between the Meuse and the right of the 2nd Bavarian Corps, from Aillicourt to Wadelincourt. G.O.A. p. 112.

[1] This example exactly resembles the one already quoted of the screen formed by the German artillery to cover the march of the Guard on Saint-Ail and Saint-Marie.

EMPLOYMENT OF THE ARTILLERY MASS TO DISORGANISE THE ENEMY'S RESERVES.—There is no need here to recall the sad memories of Sedan. It is enough to remember "the formidable artillery force of nearly 500 guns which the Germans brought into line, and which alone would have been sufficient to decide the day without the intervention of any infantry, . . . that hurricane of iron beating upon us without cessation, . . . the very reserves being shot to pieces from every direction, which completed the destruction of the army of Chalons."

G.O.A. p. 1170.

CHAPTER IV.

ARTILLERY IN THE DECISIVE PHASE.

"The decisive attack must be specially prepared by rapidly concentrating the most intense fire that can be brought to bear by all the artillery and infantry within sight of the target.

"This special preparation must be accompanied by increased efforts and fire action along the whole fighting front. . . .

"Artillery plays a leading part in the special preparation of the attack, both by bringing as many fresh batteries into action as possible, to deliver a hot fire on the selected portion of the front, and by accelerating the fire of all batteries near enough to support the attack."

(*French Field Service Regulations*, § 130–135.)

THE decisive attack is an advance by the infantry with a view to breaking through the enemy's line at a point which, when gained, will insure the success of the battle.[1] It differs from the similar operations carried out during the preparatory phase only in the magnitude of the force brought to bear and the potency of the supreme efforts required to crush the last remnant of the enemy's resistance.

Therefore artillery must be guided by the same principles in the decisive attack as it followed in the process of attrition: first preparing the way for the infantry's advance, then protecting it while the advance is carried out—that is to say, supporting it.

"Preparation" and "support" are the two words used by the drill-book to define the dual *rôle* of artillery.

[1] The ultimate objective is really not to capture this point, but to get at the enemy's réserves stationed beyond it. The possession of the point is a means to the end.

PRELIMINARY DISPOSITIONS FOR THE PREPARATION OF THE ATTACK.

RÔLE OF ARTILLERY IN THE PREPARATION OF THE ATTACK.—From the earliest times artillery when well handled has been charged with the preparation of the attack. The methods of performing this duty, however, differ according to the power of the weapons in use.

In the sixteenth century artillery used to breach the great packed squares, bristling with pikes, as if firing at the walls of a fortress. Thus at Marignan it made "great roads" in the battalions of Swiss, and at Arques "a lane" in the hostile squadron. Preparation then took place at point-blank range and immediately preceded the attack.

When, from the increased power of firearms, formations in square were abandoned in favour of lines and columns, the *rôle* of artillery remained unaltered, namely, to "clear the way for the attack."

At Wattignies "the French infantry advanced supported by the field batteries, whose shot cleared the way for them. The historian (Toulongeon) relates how the Austrians admitted that they had never before seen such terrible execution done by artillery."

CHUQUET, Vol. II. p. 208.

But the increase in gun power already allowed the preparation to be carried out at greater distances. This faculty naturally led to distant and premature preparation, which had two very objectionable features: large quantities of ammunition were absolutely wasted, and the enemy was given time to pull himself together and organise his defence before the infantry reached him. Frederick the Great used to say that "a cannonade before the general attack was inadmissible unless the Commander-in-Chief wished to attract the enemy's attention to some points, so as to conceal other movements from him.

Frederick the Great's Instructions to his Generals.

When the employment of artillery in mass was adopted at the end of the eighteenth century it was applied to the preparation of the attack; that is, the phase of the fight of which the whole aim and object is the utter destruction of the enemy both materially and morally, at some concerted point. Moral disorganisation is the fruit of suddenness and surprise in the infliction of material damage, more than of the actual amount of damage itself.

Napoleon summed this up in a well-known maxim: "The art of fighting a battle or a siege is to bring a converging fire from all sides on to the same point; once the *mêlée* has begun, the man who is clever enough suddenly to bring up an unexpected force of artillery without the enemy knowing it, is sure to carry the day."

Later on, in the days of smooth-bores, the preparation was carried out during the assembly of the columns of attack, and lasted till the time when they moved off, as after this artillery fire would have endangered the infantry. In the wars of the First Empire the great batteries used to make gaps in the enemy's line 500 or 600 yards in front of the columns of attack.

Since that period the improvement in armaments has gradually settled the principles which govern the preparation. They require that it should precede the attack as closely as possible, and that it should be overwhelming in its action; this means that it must be carried out by the whole artillery mass, and must partake of the nature of a surprise.

Let us see how these principles can be applied to the employment of the quick-firer.

But first of all it will be instructive to draw attention to one of the consequences, and by no means the least

important one, of the increase in range, with regard to ascertaining the results of preparatory fire.

With guns of short range it was possible to observe these results in the enemy's ranks with the naked eye. But at long ranges it becomes difficult and sometimes impossible to tell when the defence is sufficiently disorganised to be successfully attacked. This new feature in the preparation has been the cause of reverses which have become historical, and which have been put down, rather vaguely, to lack of sufficient preparation.

The repulse of the 49th (Hessian) brigade and the 3rd brigade of the Prussian Guard from the lines of Amanvillers, defended by Cissey's and Lorencez's division, was in great part due to the fact "that Amanvillers village, the *point d'appui* of the defence, had not so far been
G.O.A. p. 810. shelled by the artillery of the IX. German Corps."

In this instance it would have been particularly difficult to determine the effects produced by artillery fire owing to the situation of the village "on the eastern slope, so to speak, rather in rear of the crest." Moreover, even if they had shelled Amanvillers heavily, the Germans would not by that fact alone have assured the preparation beyond all doubt.

The fighting before Saint-Privat and Point-du-Jour, indeed, proves that artillery may appear to have established undoubted superiority over its opponent, while the preparation is really far from being complete.

About five in the evening twelve batteries of the Guard were in position before Saint-Privat. Nearly an hour before "they had managed to silence almost all the
G.O.A. p. 725. French artillery south of Saint-Privat, and they had successfully repulsed all the French counter-attacks. The fighting was slackening by degrees on this part of the field."

On the other hand, the twelve Saxon batteries in position to the north of Saint-Marie had on their side silenced the French guns stationed north of Saint-Privat.

So, from the want of combination in the leading of the German artillery, "the Saxon batteries being specially occupied with Roncourt and the artillery of the Guard acting against the French batteries south of Saint-Privat, it resulted that the centre of the French position was left still intact." G.O.A. p. 828.

But to an observer merely following the course of the fight, and taking into consideration the turning movement of the Saxons, it might seem that the time had arrived to deliver the attack. This, in fact, was ordered by Prince A. von Wurtemburg, in spite of General von Pape's remarks, who declared the attack premature. His opinion was vindicated by the disaster to the Prussian Guard

"At Point-du-Jour, by half-past two the French batteries had begun their movement to the rear, and the Point-du-Jour and Moscou farms were in flames. All along the line the Prussian infantry could be seen pushing impetuously forward, the French troops falling back to the ridge in scattered groups, especially about the time when Saint-Hubert was captured.

"These indications pointed to great disorganisation amongst the enemy. . . . So General Steinmetz decided to make a vigorous effort." G.O.A. p. 773.

In spite of all these signs, the preparation was not complete: we have already mentioned how the attack met with a resistance as "vigorous as it was unexpected."

Later on, about six o'clock, the French artillery "had relapsed into complete silence, and even rifle fire had all but ceased." The King then ordered General Steinmetz

to hurl every man at his disposal against the heights of Point-du-Jour, whereupon, "the moment the attack developed, the enemy bestirred himself once more, and any French batteries still able to carry on opened fire again after this long interval."

In short, this was a repetition of the reverse they had experienced three hours before, but far more severe. For a moment the Headquarters Staff had to think of insuring its retreat to the Moselle by Ars. Luckily for the Germans, the arrival of the II. Corps and the approach of night extricated the First Army from a very critical position.

Thus, at Saint-Privat as at Point-du-Jour, we see the attack delivered before the defence has been thoroughly shattered by artillery. It must be added that it was very difficult for the German generals to determine the degree of disorganisation, as the French had adopted the plan of withdrawing behind the crest-line and making no reply, which was perfectly adapted to the circumstances of the case and the crushing superiority of the German artillery.

A vigorous counter-attack by the French might have converted the German reverses into disasters. Unfortunately, the mania evinced by the French Commander-in-Chief for the defensive, kept our corps rooted to the ground. Even if his subordinates had attempted any such movements, they would have been checked by the want of reserves, and especially by the insufficiency of their artillery, both in power and numbers.

The bloody lessons of August 18th were not forgotten by the Germans. At Sedan, where their exceptional situation might well have allowed them to force the game, they played with a caution and deliberation evidently due to recollections of Saint-Privat and Point-

du-Jour. The German official account says as much quite plainly, to accentuate the merit of the operations of September 1st, and thus indirectly conveys a rebuke to the attacks of August 18th. "As a rule," it says, "the infantry (at Sedan) deferred its attack till the artillery had produced its full effect. *The guns of themselves alone dislodged the enemy from the Illy Calvary*, and it needed only a few companies eventually to occupy this important position without a shot being fired. The hail of shells with which the artillery overwhelmed the wood of La Garenne paved the way for the attack of the Guard battalions, and so *saved the enormous losses which had been the price of earlier victories*." G.O.A. p. 1235.

Prince Kraft, who was responsible for the preparation of the attack on the latter occasion, makes no secret of the anguish he felt at the fateful moment when, having fired his last round, he watched the Prussian infantry advancing to the attack. "We were in feverish expectation," he relates; "all eyes were fixed on the forest, and we wondered if the capture of its border-line would cost as many lives as the lines of Saint-Privat. But this time the resistance encountered amounted to little or nothing." PRINCE KRAFT, 4th Letter.

CONCENTRATION OF THE ARTILLERY MASS.—If the preparation of the attack by the Germans in 1870 left much to be desired, it must be admitted that their generals exercised great care in concentrating artillery with a view to this operation.

When contemplating the attack on Roncourt, after the capture of Sainte-Marie-aux-Chênes, Prince Albert of Saxony saw that it would be necessary to bring up the whole mass of the artillery for the efficient preparation of the infantry assault on the enemy's main position. He

therefore ordered General Koehler, commanding the artillery of the XII. Corps, to bring up every gun at his disposal in front of the road from Sainte-Marie to Auboué.

The concentration of the artillery mass before the point of attack selected by the commander must be carried on out of sight of the enemy, so that the preparation may come as a surprise. This may be a long business and require several hours. Some batteries, as in the preceding phases, will have to make their way under cover to their assigned positions, while others will remain in the same positions as before.

It rests with the General and other senior artillery officers to give orders for the concentration of their batteries, in accordance with the instructions of the supreme commander, and to arrange for their different lines of advance and points of assembly, etc.

No part of the field must be completely denuded of artillery to form the mass. In fact, sufficient must be left everywhere to produce redoubled efforts and intensified fire along the whole line at the time of the special preparation.

Therefore the batteries to be brought into the area of attack will be those which cannot be utilised in the adjoining portions. Here, too, will be collected batteries belonging to the larger units hitherto held in reserve and destined to form the attacking force.

Lastly, they will be joined by the batteries of second-line corps, which will have had time to come up during the preparatory phase.

Such might have been the *rôle* of the X. Corps artillery at Saint-Privat, which arrived too late from Batilly and Saint-Ail to take part in the preparation, but which did succeed in reinforcing the artillery of the Guard on the conquered position.

Field guns of large calibre suggest themselves for use whenever possible as part of the artillery to be concentrated for the preparation of the attack.

DISTRIBUTION OF TASKS AMONG THE MASSED BATTERIES.—"The correct distribution of tasks is one of the most important duties which the artillery commander has to perform. It requires a full knowledge of the supreme commander's intentions and a thorough grasp of the tactical situation." German F.A.D. § 346.

This distribution is based on the different results to be secured by artillery during the preparation and execution of the attack. We will consider it under the following heads.

For the special preparation of the attack:

Counter-batteries and batteries for preparation proper.

For the execution of the attack:

Flanking batteries and batteries to accompany the advance.

Though we have classified them so for the purpose of analysis, it must, of course, be understood that there is nothing final in this arrangement; a battery may play several different parts one after the other.

Of the batteries forming the mass, some will be already in position during the process of concentration, and others will have to change their ground with a view to the preparation of the attack, taking up positions either in the open or behind cover; others, again, will be used only to drive home the attack.

To obviate a premature disclosure of the point selected for assault, batteries already in position must guard against undue acceleration of fire, and will endeavour to deceive the enemy by slackening fire so as to throw him off his guard.

Batteries which are to take up positions behind cover may occupy them before the preparation begins, and those which are to fire in the open will remain out of sight in rear of the position till the actual moment of coming into action.

But all batteries without exception, whatever their *rôle*, must make their preparations for opening fire with the greatest care, so that it may be effective from the first round and realise to the full the overwhelming effect of concentrated masses.

COUNTER-BATTERIES.—When the preparation begins, a resumption of heavy fire must be expected from the enemy's artillery. It will be the object of the counter-batteries to keep this artillery in check by holding themselves in readiness to deliver *rafales* at any hostile batteries already in position that attempt to interfere, and at all that may subsequently show themselves.

This will result in a repetition of the artillery duel, short in duration but of extreme severity, in which the assailant must at once establish his superiority to allow the other batteries to accomplish their tasks, and enable the attacking troops to advance.

It is impossible, therefore, to take too much pains in obtaining this superiority, both by placing a sufficiency of counter-batteries in position, and by accurate preparation of ranges, fuses, angles of sight, and so forth.

A considerable number of counter-batteries may be in positions behind cover. The ones that naturally suggest themselves in this respect are those which have already been acting so during the later stages of the preliminary phase.

We have seen that the adoption of quick-firing artillery, generally speaking, entails the employment of more

counter-batteries. This is even more necessary in the preparation of the decisive attack than in the attrition phase, as the artillery must cover the compact bodies of infantry which are advancing in the open.

BATTERIES FOR PREPARATION PROPER.—On these falls the duty of piercing an opening for the attack, of destroying obstacles and clearing the track for the assault. There will not always be obstacles to destroy along the entire front, but *it will always be essential to keep down the defender's fire,* and we know how this can be done with quick-firers by a judicious use of *rafales.*

"At the moment of the assault at Graspan (November 25th, 1899), the shelters which the Boers had built became a serious drawback to them, as they could not fire downhill at close quarters without exposing their heads and shoulders to the storm of shrapnel which covered the advance of our troops." FROCARD and PAINVIN, p. 265.

Preparation batteries must, therefore, have a clear view of any such obstacles, as well as of the hostile infantry, from which it follows that they must be in the open. If substantial obstacles are encountered, recourse will naturally be had to the heavier field pieces.

In any case, whether time or percussion shell are used, *it is essential that the whole front should be swept without intermission.* The example of Saint-Privat referred to above is conclusive.

In the days of non-quick-firers it was imperative to accumulate a large number of guns and crowd them up as closely as possible, in order to obtain the necessary crushing effect on the point selected for attack. The deployment of the artillery mass was, therefore, a work of great difficulty, and influenced the choice of the point of attack. One result of the new artillery

now in use is to produce the same effect with fewer guns, which means less difficulty in handling the mass, greater choice of points of attack, not so much crowding of guns, and fewer casualties.

But if the number of guns is reduced, the difficulty of ammunition supply will be proportionately increased, for which reason the second line ammunition wagons must be brought up when the preparation is commenced.

Tasks will be assigned to batteries according to the nature and dispositions of the objective. If a locality is the point in question, the apportioning of its edges and flanks among batteries or brigade divisions will be carried out with the greatest care.

Batteries that are not used specially for the preparation will reinforce the counter-batteries, or be available for other duties during the course of attack.

THE SPECIAL PREPARATION OF THE ATTACK.

We have observed that all batteries taking part in the special preparation of the attack should open fire practically simultaneously. This supposes that the counter-batteries and those for the preparation proper can occupy their firing positions at the same moment, a condition which the conformation of the ground does not always admit.

After the repulse of the first attack on Saint-Privat by the Prussian Guard, "General von Budritzki," as the German official account tells us, "shared the opinions previously expressed by General von Pape, as to the necessity of preparing the proposed attack on Saint-Privat by artillery fire."

G.O.A. p. 835.

There seems to be confusion here as to the duties that were required of the artillery at this period of the action. The object of sending forward the artillery

of the Guard, as was then done, was to extricate the infantry and not to prepare the attack.

The real preparation was carried out later, after the capture of Roncourt by the XII. Corps. Then at last there was some combination between the Guard and the Saxons in their efforts against Saint-Privat, and the Germans formed a ring of 24 batteries, either Saxon or Prussian, at a distance of 1100 to 1300 yards round the village. This manœuvre was forced upon the Germans by a series of episodes which began by the crushing of the Guard infantry, but the way in which the preparation was carried out showed a want of calculated organisation.

Could the batteries of the Guard have carried out the preparation while remaining in the Saint-Ail positions? It is very unlikely. On the other hand, if they had pushed forward without the protection of the infantry, they would have shared the same fate as the latter.

So they had to wait and prolong the preparatory phase until the XII. Corps had captured Roncourt. This enabled the Saxon artillery to take up a position north of Roncourt, under cover of the great ravine running east and west. Otherwise the defenders, temporarily relieved from difficulty on the south-western side, might have brought troops round to the north and dealt a heavy blow to the artillery movement, which the Saxons carried out on the bare glacis of Roncourt.

Now was the time for the preparation phase of the attack to have been commenced simultaneously by the artillery of the XII. and Guard Corps. The latter, leaving some of its batteries in position at Saint-Ail as counter-batteries, might have pushed the remainder

under their protection right up to the skirmishing line, whence they could have prepared the assault.

Similarly, if some of the preparation batteries are told off to destroy obstacles or make breaches, etc., and if the nature of the ground or other circumstances compel them to get close up to their target to carry out their orders, it will not be possible for them to begin work till after the other batteries.

With long-range weapons the preparation must not be carried out while the attacking troops are being assembled 2000 or 3000 yards from the enemy and even further. This would reveal the intended point of attack far too soon, besides which it would be impossible to maintain a heavy fire uninterruptedly till the moment of assault.

So the special preparation will begin just as the attacking troops are on the point of showing themselves, and will be continued while the infantry are advancing under rifle-fire, ending in a general *rafale* when the attacking force is actually ready to assault the position.

Thus at Sedan, "after a final formidable salvo delivered at the wood of La Garenne by the whole line of the Guard artillery, fire ceased, and the leading column of attack began to ascend spur 285, west of the Givonne."

G.O.A. p. 1195.

The artillery must then increase its elevation "to sweep the ground in rear of the position and prevent the reserves from coming into action."

German F.A.D. p. 346.

The German account relates how, on August 30th at the time of the attack on Mouzon, "every gun in the first line opened fire on the enemy's positions in the suburbs of Mouzon and the Rouffy road, thus preparing the attack of the Prussian battalions by most effective fire. Then when the latter had pushed further to the front, they took as their target the lines of artillery and

masses of infantry which they saw on the opposite bank of the Meuse." G.O.A. p. 1037.

At the same time the Germans did not simply raise their sights with the ease and precision of practice-ground manœuvres, as the complacency of the official account might lead us to suppose; for, a few pages further on, the same account admits that "the Prussian batteries in position on Mont Brune combined with the French guns for a considerable time to obstruct the advance of the attacking troops." G.O.A. p. 1041.

Before the assault of Saint-Privat, which resulted from the initiative of subordinates, no special instructions had been given to the artillery. It was by request of the Generals on the spot that it suspended its fire at the village. G.O.A. pp. 847, 848

So imperfectly was this order observed that "the German shells continued to fall in the village, even during the assault, and some regiments which had actually got inside had to be again withdrawn." G.O.A. p. 853.

These examples show how difficult it is to carry out the apparently simple instructions of the drill-book: "Increase the elevation when the attack arrives within 500 yards of the enemy."

Moreover, as we have observed in considering the question of firing over the heads of one's own troops, artillery should continue to fire well beyond the limits laid down in the drill-book. It is impossible to give precise figures in this respect, for the limit of safety depends on the ground, the extent to which the target and one's own troops can be seen, as well as accuracy in ranging. All we can say is that artillery must continue to fire as long as possible, and percussion shell may be used after time shell has become too dangerous. High explosive shell, however, must be discontinued at the

latest when the troops get to within 500 yards of the enemy, or must at least be fired with increased elevation after that stage has been reached.

The quick-firer gives fresh point to the arguments in favour of carrying out the special preparation during the advance of the infantry, for the rapidity of its fire necessitates a proportionate curtailment of the time during which it can be maintained.

Supposing that the attacking troops disclose themselves 2200 yards from the enemy, and that the preparation fire is not opened till then, it will take at least twenty minutes for the troops to cover 1700 yards —that is, to get within 500 yards of the position. It would be a physical impossibility, even under these circumstances, to keep up the maximum rate of fire for all that time without intermission. Such fire could only be maintained at the cost of such expenditure of ammunition as would be quite inadmissible,[1] to say nothing of the fatigue to detachments and the heating of the equipment. It would therefore be a case of alternating *rafales* with slow continuous fire, as has been already explained under the head of fire tactics.

An effect of continuity will be obtained if the large number of batteries in action fire *rafales* in succession. The slow series, apart from the reason already adduced to justify their employment, will have the additional advantage of maintaining the veil of smoke; but it must be observed that the permanence of the smoke depends as much on the state of the atmosphere as on the intensity of fire.

Senior officers of artillery, whose duty it is to direct the special preparation, must give orders on the follow-

[1] Two hundred rounds a gun, reckoning at a speed of ten rounds a minute, which is not at all out of the way.

ing points: alternations of *rafales* and slow fire, degree of intensity of the latter, depth of *rafales*, and the succession of time and percussion *rafales*.

If high explosive shell is employed, it may be a good plan to detail at once the batteries that are to use it, which must therefore concentrate their fire on targets or portions of targets that are already being attacked by other batteries with shrapnel. In this manner it will be possible to avoid the mistakes and delays inseparable from a hurried change of projectile.

EXECUTION OF THE ATTACK.

FLANKING BATTERIES.—As the special preparation of the attack by the artillery takes place while the infantry attack is in progress, the latter are protected from the enemy's guns by the counter-batteries, and from the hostile infantry in their front by the preparation batteries.

But this protection is not enough. The flanks of an attacking force are very vulnerable, and it is here that the defending infantry will aim a blow, either by fire action or offensive movements—that is, counter-attacks.

This lateral protection supplies the task of the flanking batteries, which guarantee the safety of the flanks of the main attacking force as soon as it comes within effective rifle range. Their method of action, like that of the preparation batteries, consists of *rafales* alternating with slow fire, and must be prepared beforehand by registering ranges, etc., in order that a heavy fire may be suddenly opened on any counter-attack attempted by the enemy.

The flanking batteries may be specially detailed for this duty from the beginning of the preparation; they may equally well be taken from among the counter-batteries or those for the preparation proper during the course of this process or at the end of it. All depends

on the number of batteries available and on the time occupied in the preparation and execution of the attack—in a word, on circumstances and the nature of the ground.

If, for instance, the attack develops within effective rifle range of the enemy, it is evident that the same battery cannot simultaneously fulfil the *rôle* of a counter or preparation battery and that of a flanking unit. If, on the other hand, the attack is developed 2700 yards from the enemy, and especially if its advance is slow, there will be time to detail the flanking batteries from among those which have joined in the artillery duel or in the preparation.

ACCOMPANYING BATTERIES.—We have just seen how artillery can prepare the attack and how it can protect it, but it still remains for it to move in support. Artillery can only give this material and moral support to the attack by "making single batteries or brigade divisions accompany it in its advance to within decisive range. The attack thereby gains so much in *moral* that the probable heavy losses of the artillery are largely compensated."

German F.A.D. § 347.

Artillery that has pushed close up to the enemy can sometimes produce considerable material effect.

On August 18th the 3rd light battery of the VII. German Corps (Captain Gnugge) maintained its position behind the garden of Saint-Hubert, in spite of an incessant fire which took it in enfilade and reverse. "From the fact that he occupied the most advanced point of the Prussian infantry line, Captain Gnugge was so close to his objective that his fire took great effect. Thus, time after time, he drove back the enemy's guns and infantry columns, which were endeavouring to come into action near the Moscou farm, at that time in

flames, or to deploy in that direction within less than 1100 yards." G.O.A. p. 777.

This conception of accompanying batteries is no novelty. Frederick the Great advised his artillerymen not to fire over the heads of the infantry, but to advance alongside them. "The pieces of light calibre," wrote Guibert, "double-manned with men and horses, push forward in front of the attacking line." LISKENNE, Vol. V.

The increased range and power of firearms could in no way diminish the moral and material obligation for batteries to accompany the advance any more than it impeded their progress. Whatever the range of the weapons in use, these batteries have to get within decisive reach of the enemy, whether that means 200 yards, as with the smooth-bore, or 1000 yards with the arms of the present day.

On the other hand, accompanying batteries participate in the protection afforded by the rest of the artillery to the attacking troops, and we know how much more efficacious that protection is in proportion to increased gun power. With quick-firing artillery the necessity for accompanying batteries makes itself felt perhaps more than ever.

The enemy need place but a few guns or even a single one, in a flanking position behind some obstacle or simple protection like a covered caponier in his artillery position, to bring a most destructive cross-fire on the attacking troops; it is, therefore, necessary that these should be given some artillery to guard against such an occurrence.

These forward movements of artillery must invariably be carefully prepared and organised. If batteries are launched on to unreconnoitred ground, before every possible means has been taken to insure their security, and the numbers employed adjusted to the object in

view and the amount of room available for manœuvring, they will be exposed to the most serious risks.

When the 1st German Army developed its attack against Point-du-Jour (about three o'clock), eleven batteries received the order to cross the defile formed by the road, and take up a position on the eastern slopes of the La Mance ravine. This mass of artillery was committed to one single road, that of Gravelotte, mixed up with infantry and cavalry, from which resulted indescribable confusion.

The four leading batteries alone managed to get across the ravine. The others turned back and reclimbed the slopes of Gravelotte, where they might well have met with disaster in spite of the protection of the batteries left in position in rear, had the French but had any efficient artillery at their disposal.

At Sedan, when the Prussian Guard was making its attack on Givonne, "ten French guns were hurled into the village in a final effort, as impetuous as it was ill-considered. They were all surrounded and captured before they had time to unlimber."

ROUSSET, Vol. II. p. 318
G.O.A. p. 1135.

How will the accompanying batteries be selected? Obviously, unless there are special reasons to the contrary, from among those which normally belong to the units forming the attacking body. This is the time of all others to work with troops that know each other and are used to manœuvring together.

Batteries to accompany the attack, like the flanking ones, may be taken from among those which have joined in the preparation, or may be specially told off for this duty from the first, which is preferable, as a rule, unless there is a shortage of artillery. As regards the actual number, there will be wide differences, and no precise rule can be given in this respect.

At the Imperial Manœuvres of 1899, the Germans,

though their drill regulations are fairly broad-minded, were in the habit of making three batteries per division accompany the attack. This tendency to a hard-and-fast rule can only be explained by the desire not to split up the brigade division, the tactical unit.

How will batteries accompany the infantry? Step by step or by rushes?

To give infantry the material support of its fire the artillery must halt, and in consequence be left behind; to afford the moral support of its presence it must march at its very heels.

If the ground admits of rapid movement, and affords good positions, batteries may halt for a moment, deliver a few *rafales*, and rejoin the infantry almost without losing touch; if the ground is intersected and necessitates a slow pace, they cannot halt without separating themselves from the attacking troops. Then, again, some of the accompanying batteries may advance by rushes, while others follow the progress of the attack step by step.

The essential point is that *the infantry should feel the constant and immediate support of the accompanying batteries, and that these should reach the conquered position at the same time as the infantry.*

CONDUCT OF ARTILLERY IN THE DEFENCE. We know that all the efforts of the defence must be directed towards refitting their batteries, and, if possible, concentrating new ones. What use is to be made of the fresh mass thus formed?

The German regulations are quite clear, and leave no possible doubt as to the course to be followed. "Directly the adversary advances to the decisive attack the artillery must bring every gun into action again, even without orders, and fire solely at the enemy's infantry, taking no notice of his artillery."

These strict injunctions are nearly word for word a repetition of smooth-bore artillery precepts.

The drill-book adds: "Single batteries may be advantageously employed at this period in surprise positions elsewhere." This remark is in consequence of the increase in artillery power, and of the considerable effect produced by a small number of quick-firing guns.

It is but keeping up the tradition of smooth-bore days, when the same regulations imposed on artillery the duty of "evincing the most dogged tenacity, even if such tenacity, to its everlasting honour, should result in loss of guns." "'Tis the last round of case which tells most," Guibert used to say; "artillery must make it a point of honour not to save its weapons from capture, which after all are machines that can easily be replaced, but to make effective use of them up to the last possible moment."

German F.A.D. § 359.

LISKENNE, Vol. V. p. 452.

"Never abandon a gun," says Gassendi, "till the enemy is in the battery. The last rounds are the most effective, and they may prove your salvation, while unquestionably your glory."

Yet how could the powers of the smooth-bore compare with those of our present gun? Artillery armed with shield-protected quick-firers, which even though weak in numbers, is prepared to sacrifice itself, and which, from the near approach of the enemy's line, is no longer exposed to his artillery fire, will prove a very hard nut for the assailant to crack.

OCCUPATION OF THE CAPTURED POSITION. REPULSE OF THE ATTACK.

We have said that the accompanying batteries must reach the conquered position at the same time as the infantry.

The situation of the attacking troops, exhausted and

disorganised as they are by their final efforts, will, indeed, be very critical as long as their tenure of the position is not confirmed by the arrival of fresh reserves and the main body of artillery. They would be flung headlong back by any counter-attack that the defenders might organise with some infantry reserves and a few batteries in covering positions.

"Part of the artillery," says the German drill-book, "must push rapidly forward to the captured position, the moment success is assured, to support the infantry which is occupying it. This is one instance where an artillery commander, without waiting for instructions, must himself order a change of position. . . . All the batteries *en masse* conform to the movement at a rapid pace.

"At a time like this, when all are converging and press towards the captured position, and when every effort must be directed at breaking down the last remnant of the enemy's resistance, all considerations as to the intervals to be left between batteries are thrown to the winds. The intervals between subdivisions can be reduced to the lowest point compatible with the service of the guns." German F.A.D. § 348.

The drill-book appears thus to have taken as its model the movements performed by the German artillery on August 18th, in its formidable advance to the Saint-Privat position.

Artillery must certainly approach the enemy's position in proportion to the progress made by the attack directly the enemy retreats beyond effective range, in order to follow him up with its fire, and hurl itself on to the captured position in one rush.

Certainly also the initiative of subordinate leaders, the dashing enterprise of all, and *the general determina-*

tion to get forward, are indispensable elements of final success. But it is equally indispensable to make use of a powerful force of artillery to guard against the ever-present possibility of the attack being repulsed. This force will be formed from some of the preparation batteries, while the remainder make a dash for the position.

"If the infantry attack fails," say the German regulations, "the artillery, particularly that part of it which is most advanced, must cover the retreat of the infantry and arrest the enemy if he tries to pursue."

German F.A.D. § 349.

This terseness accords with the general spirit of the regulations, which are conceived specially with a view to success.

The duty of the artillery in case of a reverse is, nevertheless, made clear in the above lines. This problem is an overwhelming one, and the business of the commander is to provide the means that will enable batteries to carry it out. A strong force of artillery in a covering position is the key to its solution.

At Saint-Privat even before the final assault was delivered, the Horse Artillery Brigade Division of the Guard moved off and gave the signal to the other batteries.

This general and spontaneous movement of all the artillery, not only belonging to the first line, but also of the second line corps, might have been attended with danger had the defender possessed sufficient reserves to make a vigorous counter-attack on the leading batteries and drive them headlong back on those which were following hard upon their heels. There would have been none left in position further back to arrest the enemy's onslaught, at any rate south of the high road.

Altogether a line of twenty-four batteries was deployed on the Saint-Privat position, while to the south of it there was no more artillery in reserve behind this line. To the north the Saxons had kept nine batteries in *échelon* in rear.

It must be added that this powerful line of guns had been accumulated by degrees, and some of the batteries did not come up till it was nearly dusk. The movement appears to have been begun about half-past seven.

In the 1st German Army, after the capture of Saint-Hubert's farm, when General Steinmetz delivered the first unsuccessful attack against Point-du-Jour about three o'clock, the dispositions seem to have been made with an eye to failure. "If they were unsuccessful, retreat was doubly assured, first by the edge of the wood, which was strongly held, and secondly by the powerful force of guns in action to the north and south of Gravelotte."

With regard to this it is curious to notice how the German Official Account, which nevertheless has plenty to record in favour of the German arms, carefully passes over in silence the disadvantages and dangers presented by certain operations, while emphasising with complacency the precautions taken elsewhere, under similar circumstances, to guard against the same drawbacks and dangers.

The power of the quick-firer will obviate the necessity of accumulating such an excessive number of guns in a relatively cramped position, and will do away with the crowding, always a cause of confusion, which spells disaster in case of the slightest reverse. It might be possible to get the guns on to the captured position, but not the ammunition necessary to maintain them in action, so it will be better to have fewer guns and keep them well supplied.

The artillery of the defence at Saint-Privat was too inferior to check the attack.

But yet the part it played is worthy of notice, as it clearly indicates the conduct to be pursued under similar circumstances.

The exhausted batteries of the 6th Corps, led by Lieut.-Colonel de Montluisant, and the fresh batteries either of the general reserve or the Imperial Guard, arrived late in the day, and were insufficient to prepare a counter-attack, for which, moreover, there was no infantry available. The most they could do by establishing themselves to the east of Saint-Privat and in front of the Amanvillers quarries, under cover of darkness, was to prevent the Germans debouching from the position.

CHAPTER V.

ARTILLERY IN THE CULMINATING PHASE.

"If successful the artillery will pursue the beaten enemy with its fire; in case of a reverse it will delay the pursuit, and under its protection the troops will rally in successive positions."

(*French Field Service Regulations*, § 135.)

PREPARATION AND COMMENCEMENT OF THE PURSUIT AND RETREAT.

The culminating phase, that is, pursuit for the victor and retreat for the vanquished, begins properly speaking when the capture of the position by the assailant is an accomplished fact.

Artillery is essentially the arm for pursuit, "for it combines mobility with effective fire action"; it is likewise specially valuable in retreat, for it alone can hold the enemy's fire sufficiently in check to enable the columns to effect their retreat in good order. German F.A.D. § 361.

The efforts of both sides to bring as many batteries into action as possible will necessarily result in an artillery engagement. This deployment of guns will be characteristic of the last phase of the action as much if not more than of the commencement of the fight, though resulting from very different causes.

The artillery of the assailant will occupy the captured ground, while that of the defence takes up a covering position to the rear. Thereupon the victor must see to telling off the batteries that are to take up the pursuit, refitting them as far as may be necessary. It is out of

the question, indeed, to send the whole mass of artillery after the enemy: this would only block the roads and spin out the length of columns indefinitely, thereby hindering operations to a great extent.

In case of retreat, as we shall see in a moment, a certain number of batteries remain attached to the infantry, while the remainder manœuvre in mass. It will first of all, therefore, be necessary to reapportion the tasks of the various batteries.

Speed is a prime factor of success in the pursuit, therefore artillery must take it up the very moment the position is occupied.

German F.A.D. § 361.

As regards the artillery of the retreating side, "its duty is to hold the enemy back regardless of the possibility of losing guns."

G.O.A. p. 1002.

On August 30th, after Beaumont was taken, about two o'clock, "there came a pause in the action of the Prussian infantry," and the struggle resolved itself into an artillery duel. The Germans established a long line of twenty-five batteries. The French formed up those still able to fire (ten, certainly) on the heights north of Beaumont, and made a rampart of them behind which the beaten troops could seek shelter.[1]

G.O.A. p. 1002.

PRINCE KRAFT, 4th Letter.

In the words of General Dresky, artillery really acts as a reserve to cover the retreating troops.

The capture of Beaumont took place about two o'clock; but it was not till half-past three that the Prussians resumed the offensive after a few moments' rest, when six Prussian batteries joined in the movement.

G.O.A. p. 1003.

At the beginning of the artillery duel "the French machine guns had been forced to withdraw from the

[1] According to Rousset (Vol. II. p. 343) we had only eighteen guns and three machine guns. This is what the German Headquarter Staff calls a "powerful line of guns," on p. 1003.

fight; but the remaining batteries continued their gradual retreat northwards till three o'clock." G.O.A. p. 1010.

So by the time the Prussians reached the heights occupied by the French batteries everything had disappeared. "The lie of the ground to the north and the thickets of the Givodeau woods prevented any view being obtained of the country beyond, in which direction the front of the IV. Corps now faced. On the left could be heard the sound of the Bavarians' fire, getting further and further away to the westward. When the enemy was driven from his position at Beaumont, and had withdrawn the last of his batteries, he was completely out of sight, and from that moment there was nothing to show whether he had made good his retreat towards the north or the west." G.O.A. p. 1018.

Thus the 5th French Corps, though weakened, shaken, and completely taken by surprise, managed to get clear away from three German Army Corps, though only for a time, alas! The facts stated in the Headquarter Staff Account contain in their terseness the highest tribute that can be paid to the French batteries, and, at the same time, the most scathing criticism of the German operations. Further comment would but detract from their weight.

But this much may be said—namely, that had some of the German batteries, supported by a few battalions, made a dash for the heights of Beaumont directly the village was taken, instead of devoting themselves for more than an hour to a harmless cannonade, the disaster of Mouzon might well have ended in the utter destruction of the 5th Corps.

EXECUTION OF THE PURSUIT OR RETREAT. "Once the pursuit is commenced, the sole object must be to push rapidly forward, and to this end all means are

admissible. Orders as to change of position can no longer be given in minute detail, and it is here that the initiative of individual officers finds its opportunity, down to and including battery commanders. Flanking fire is particularly effective."

German F.A.D. § 362.

Even when there appears to be no likelihood of its immediate employment, artillery must always be well to the front, so as to be ready for instant action if wanted, and to allow the enemy no respite.

"In the pursuit, artillery will not hesitate to fire at the longest ranges. It will often be best to make the most distant detachment of the enemy the target, for thus will retreat most easily be turned to a rout."

German F.A.D. § 362.

Movements in retreat are carried out similarly to those in the attack, but with the contrary motive of retiring instead of advancing. We have observed that the withdrawal begins under the protection of the massed artillery, which retires in its turn, provided it has been able to perform its task without loss of guns. A few batteries will be attached to the infantry, and occupy a secondary line of resistance to steady their march. The mass may then take up a second main position, if circumstances should render it necessary.

As the characteristic feature of a retreat, we find artillery alternately deploying and breaking off the action, reversing the action of the attrition stage following the initial concentration of the mass which precedes the deployment of artillery for the special preparation of the attack.

In the attack, no offensive movement can be successful without the mutual support of the two arms; in retreat, the same mutual protection alone enables the fight to be broken off—that is, fire action by artillery and counter-attack by the infantry.

In retreating, artillery always moves off at a walk, but breaks into a trot as soon as it "has passed the first few lines of infantry"; and this point needs emphasis, as by this method alone is the mutual assistance of the two arms rendered possible.

The batteries which move with the infantry have a very critical part to play, in which the importance of manœuvring power becomes doubly apparent. They must not hesitate, in case of need, to let themselves be crushed; their mission will have been accomplished if, by so doing, they have enabled the other troops to get away.

The pursuit will endeavour to threaten the flanks of the retreat, so it is "the flanks that must be more especially guarded. Artillery stationed on the flanks greatly facilitates the march of the column." German F.S.R. § 164.

Favourable positions for covering a retreat are likewise to be found "in rear of a defile, and anywhere whence it is possible to withdraw without attracting the enemy's attention." German F.A.D. § 363.

The conduct to be pursued by artillery is in no way modified by the employment of the quick-firer, which admits of considerable effect being obtained in a short space of time with a limited number of guns; but it will be possible for it to render incalculable service both in pursuit and in retreat. A few guns, rapidly brought into position at the right spot, may well produce decisive results on the enemy's retreating troops. On the other hand, when retiring, it requires only a few guns, well concealed and ready to sacrifice themselves, if necessary, to delay the enemy, by obliging him to concentrate considerable forces; and any check to the pursuit may be the salvation of the column.

In the retreat from Beaumont to Mouzon, after

evacuating the heights of La Harnoterie, the 5th French Corps took up a second covering position between Yoncq and La Sartelle farm. But finding itself shortly afterwards outflanked by the Germans, it withdrew to a third position at Mont Brune-Villemontry, leaving an infantry regiment in the Givodeau woods to cover the movement, and a few reserve batteries on spur 295, with detachments of infantry as escort. General Lebrun, commanding the 12th Corps, had despatched a brigade of infantry, three batteries, and a cavalry brigade to the left bank of the Meuse to cover the retreat of the 5th Corps.

So, then, we see two successive positions taken up in carrying out this retreat. The first, but weakly defended, its garrison being looked upon as sacrificed, was held in order to give the main body time to occupy the second in force. The latter formed a bridge head on the left bank of the Meuse, to facilitate the passage of the army corps to the right bank. A strong force of artillery should have been established in this position, and the three batteries sent by the 12th Corps were far from balancing the losses suffered since the commencement of the action. Artillery so placed, with the Meuse in its rear, would have been in the most critical position, but would have played its part if, in losing its guns, it had covered the passage of the river.

At this time the situation of the unfortunate 5th corps was lamentable indeed. "Our infantry, hunted from one position to another for more than five hours, hardly preserved the semblance of cohesion; while our artillery, three parts of which had been dismounted, was running very short of guns and ammunition."

ROUSSET, Vol. II. p. 246.

Here, to all appearances, was an easy prey for the victor, but in spite of his formidable superiority, the

latter did not use his artillery with the vigour and dash that the situation demanded.

Thus when the IV. Corps advanced against the position along the Givodeau wood and hill 295, *only one battery*, the 3rd Heavy one, resolutely followed the forward movement of the infantry. The commander, Captain Dieckmann, decided on his own initiative, after La Harnoterie farm was taken, "to go and take up a position at the cross-roads 286, whence he began to shell height 295." G.O.A. p. 1029.

The hill was captured by a converging infantry attack, which was successful owing to superior numbers, but practically without assistance from the artillery.

As regards the French batteries, they let themselves be annihilated, as was their duty.[1]

A single German battery, the 3rd as before, pushed forward of its own accord to hill 295 as soon as it was taken, and promptly opened fire. This was hardly enough to support the infantry, and the officer in command was obliged to send messengers "to bring more artillery on to the conquered hill." G.O.A. p. 1030.

The corps artillery and that belonging to the 7th division, eight batteries in all, had, indeed, come along in rear, but without hurrying themselves; "they had got as far as the southern edge of the Givodeau wood, but the screen formed by the trees separating them from the heights of Yoncq had prevented them seeing what was taking place on the hill, and they had halted." G.O.A. p. 1031.

The German Staff, not to lay itself open to criticism, carefully omits the fact that the halting-place of the artillery was under 2200 yards from the hill!

[1] "Two of the enemy's guns, which had kept on firing to the last moment, fell into the hands of the 93rd, in spite of the efforts made by their infantry escort. . . . The pursuit resulted in the capture of ten pieces of ordnance." (G.O.A. p. 1029.)

The Horse Artillery Brigade Division thereupon dashes off at full speed and reaches the position "about the same time as the 3rd Heavy battery."

Two batteries of the 8th division arriving from La Harnoterie likewise came into action. When the remaining batteries of the IV. Corps at last arrived, "want of space obliged them to remain at the foot of the hill. One battery, however, did manage to get four guns in position."

G.O.A. p. 1031.

However, the lesson was not taken to heart, and the Prussian artillery during the second phase of the pursuit continued to act as dilatorily as before.

Whilst the infantry pushed ahead and made preparations for the attack on Mont Brune, the artillery of the IV. Corps remained idle, or "engaged the French artillery at very long range with no appreciable result," as even the Germans themselves admit.

"*Only one battery*, the IV. Heavy, under Captain Laube, had left the inadequate position which it occupied on the Yoncq hill, and, picking its way between the landslips with which the steep slopes were covered, had by supreme efforts managed to establish itself to the east of Grésil. So this was the only battery that supported the infantry attack, and the incident of hill 295 was repeated at Mont Brune, but on a larger scale."

G.O.A p. 1032.

Directly the positions were captured, the commander sent "officers to fetch some artillery." To fetch some artillery! In these significant terms the official account sums up the situation.

G.O.A. p. 1036.

Had some of the IV. Corps' main force of artillery followed the infantry and dashed after it on to Mont Brune, instead of arriving piecemeal after the occupation of the position, how terrible might have been the consequences if the batteries had immediately opened fire

on the French troops fleeing in disorder towards Mouzon.

The remarks suggested by the conduct of the artillery of the IV. Prussian Corps, in the pursuit of August 30th, apply perhaps even more forcibly to the Saxon artillery.

As we have seen, the latter never thought of protecting the right flank of the XII. Corps from the fire of Lacretelles' French division posted on the right bank of the Meuse. It made no effort to advance with the infantry any more than the Prussian artillery. When the column, which was making its way along the Meuse, was assailed by fire from across the river, "officers were detached to go and fetch some artillery." G.O.A. p. 1025.

Luckily for the Saxons, these officers came upon the VI. Heavy battery, which had just arrived at the Fays wood, and which continued its advance. Seven other batteries eventually came into action, out of the fifteen which formed the artillery of the XII. Corps.

CHAPTER VI.

THE ATTACK OF FORTIFIED POSITIONS IN THE FIELD.

A BATTLEFIELD is by no means all open ground; it is composed of a number of tactical points, localities, and entrenchments, with obstacles which may be natural or artificial. It is a question of degree, and to speak of employing artillery in the attack of entrenched positions does not precisely convey a definite meaning.

General principles remain the same. Certain methods of employment, however, may become particularly important, according to the nature of the obstacles or cover in question, as also from the power of the guns brought into play. The latter question cannot be discussed here, as it requires to be separately studied.

It is interesting to notice, however, how much attention the Germans have paid in their drill-book to this eventuality, "the attack of fortified positions in the field." Their Field Service Regulations of January 1st, 1900, mention it, and the artillery drill-book devotes considerable space to the same subject, with many completely new additions.

These items deal principally with the employment of special calibres; they also give the different organisations which may be got into working order according to the time the troops remain—namely, reconnaissances,

observing stations, communications, ammunition depots, and such like.

As regards instructions of general import, they are summed up in the following: "One of the most necessary duties of the commander is to regulate the gradual deployment of infantry in proportion to the progress made by artillery, by whose fire the advance is supported." German F.A.D. § 354.

This duty, it may be added, remains the same, whatever the circumstances or nature of the attack.

The principles of warfare are, indeed, the same, whether the fighting is behind entrenchments or in the open field. "In a siege," wrote Frederick, "in a battle, or in war on a large scale, the advance is made methodically, supported by some kind of parallels up to the objective."

This idea has evidently given birth to the theories of General von Sauer, who treats the attack of fortresses by assault as though it were a field operation, and consolidates his views by deducing the rules for such attacks from those laid down in the "German Infantry Drill Regulations." *Revue militaire de l'étranger*, 1889, p. 596.

The German Field Artillery Drill-book seems to have authorised this tendency in assigning a special paragraph to the attack of fortified field positions.

The arrangements there prescribed for such cases have this peculiarity: they legislate for attack and not for defence. This is the keynote of their whole system, which is characterised by the bold spirit of the assailant, and shatters all obstacles of every description that lie in the path of the invading armies.

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